MONTHLY NOTICES

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W. H. MAW, Esq., PRESIDENT, in the Chair.

Rodney Boyce, Soudan Survey Department, c/o Royal Colonial Institute, Northumberland Avenue, London, S.W.;
Arthur Cleminson, Deputy Commissioner of Lands, Lagos, West Africa;
George Innes, M.P.S., Olive Bank, Liberton Brae, Edinburgh;
Arthur Kent Lucke, Suez Canal Company's Service, Transit Department, Ismailia, Egypt; and
George Street, M.A., Merton House, Southwick, Sussex,

were balloted for and duly elected Fellows of the Society.

The following candidates were proposed for election as Fellows of the Society, the names of the proposers from personal knowledge being appended:—

Edward George Bloomfield Barlow, Ditton Lodge, Stourwood Avenue, Bournemouth (proposed by Col. E. E. Markwick);
Lieut. F. G. Cooper, R.N.R., H.M.S. *Ocean*, 131 Sutton Court, Chiswick, W. (proposed by E. W. Owens); and
Edward Power, F.S.A., F.G.S., 16 Southwell Gardens, S.W., and Watership, Newbury, Berks (proposed by W. S. Franks).

Fifty-one presents were announced as having been received since the last meeting, including, amongst others:—

W. H. Pickering, Lunar and Hawaiian physical features compared, presented by the author; 20 charts of the Astrographic Chart of the heavens, presented by the Royal Observatory, Greenwich; Engraving from portrait of Sir William Huggins, painted for the Royal Society, presented by the subscribers to the Huggins Portrait Fund.

The Perturbations of Halley's Comet. By P. H. Cowell and A. C. D. Crommelin.

Shortly after the December meeting we decided to undertake jointly the computation of the perturbations of Halley's Comet. Wishing to ascertain as rapidly as possible whether Pontécoulant's date of the next perihelion passage (1910 May 23) was approximately correct, we made a preliminary computation of the Jupiter perturbations, dividing the comet's orbit into eighty portions, and closely following Pontécoulant's method. We introduced, however, two modifications, which we think are improvements :—

(1) Pontécoulant has made his computation needlessly long by the retention of a number of meaningless and superfluous figures; thus he determines the perturbing forces X, Y parallel to the principal axes of the ellipse to two places of decimals, implying, as a rule, three significant figures; but the product of these, by the factor reducing the perturbation to seconds of arc, is given to six significant figures, of which only three can be trusted. We have restricted ourselves to the reliable figures, which involves no loss of accuracy.

(2) Pontécoulant performs the multiplication by these factors separately for each element of the orbit. We have first taken the sum of the components and multiplied by the reducing factor once for all at the end, thus saving much labour.

We are now undertaking a more accurate investigation of the perturbations, dividing the orbit into 180 portions, and including the perturbing effect of Venus, the Earth, and Neptune, which Pontécoulant did not consider. We therefore deem it unnecessary to do more at present than give the two main results of our preliminary work, which are as follows :—

(1) 1910 May is the correct date within a month for the next perihelion passage. Our actual result is a fortnight earlier than Pontécoulant's, but we lay no stress on the difference.

(2) Our computations confirm the suspicion expressed in December, that Pontécoulant's value of the eccentricity in 1910 is notably in error. In fact, we make the perihelion distance appreciably the same as at the last return (0·59), whereas he increased it to 0·68. This change is of some importance, as it would considerably affect the geocentric path of the comet at the next return, and would also considerably modify the point at which the meteors accompanying the comet would intersect the Earth's orbit.

Result (1) indicates that Ångström's curve fails utterly for the next return, and throws much doubt on the reality of his two inequalities. Possibly many of the earlier returns of the comet have been wrongly identified by Hind and Ångström, and the latter's curves may thus be erroneous.

On the Errors of a Photographed Réseau. By W. H. M. Christie, A. S. Eddington, and C. Davidson.

The investigation which is here described was undertaken in connection with the discussion of the results of the Greenwich photographs of Eros 1900–1901. The determination of the division errors of the réseau as imprinted on the photographic plates to the very high degree of accuracy required, is in some respects a new problem, so that some of the methods and results may be of interest.

An account of the preliminary determination of the errors of the réseau (No. 90), which was used for all the Eros photographs, is printed in the Introduction to the Astrographic Catalogue, Greenwich Section, vol. i. p. xxxvii. These provisional division errors were applied in the reduction of the measures of photographs, but a much more extensive investigation was felt to be necessary in order to deduce a trustworthy value of the solar parallax from the results.

A preliminary comparison made in 1903 between the réseau itself and photographs of it on seven plates had shown that there were sensible differences, which called for further discussion after the heavy work of measurement of the Eros plates had been completed. It may here be explained that the réseau is imprinted on the photographic plate by parallel rays from an electric lamp in the focus of the 13-inch object-glass of the Astrographic telescope, the réseau and the plate being mounted face to face, as nearly as possible in contact just outside the object-glass. It is to be noted that the parallel rays necessarily pass through the glass of the réseau from the back before falling on the silver film.

Under the ordinary conditions the réseau is reversed with the telescope in passing from east to west of the pier, the same edge of the plate being in contact with the bearing studs, on both sides of the pier. In consequence of this reversal the division errors of the central line 14 and the adjacent line 13 or 15, between which Eros is usually placed, affect the R.A. of Eros with opposite signs on photographs taken with the telescope east and west of the pier respectively, and thus directly enter into the value of the parallax deduced from morning and evening photographs, with telescope east and west respectively.

It was therefore necessary to determine the division errors of lines 13, 14, 15 with a degree of accuracy far beyond that required for the other lines.

What was required in this new investigation was the error of that part of the réseau where Eros falls, referred to the mean of that part of the réseau on which those stars fall, from which the co-ordinates of the plate centre were deduced. In the Greenwich results three series of places of Eros have been determined, viz. (1) Astrographic photographs using *reference stars* selected within 55′ of the centre; (2) Astrographic photographs using *comparison stars*

selected within 25′ of the centre; (3) Thompson photographs using *comparison stars*. In series (2) the comparison stars may be considered to be, in the mean, fairly uniformly distributed over the square between the lines 9 and 19 in each co-ordinate; while in the other two series the stars were distributed over the square between lines 4 and 24. Different corrections must be applied to Eros in the two cases.

There were three steps in the determination:—

(1) A more accurate measurement of the errors of lines 13, 14, 15 on the silver réseau.

(2) Measurement of the systematic differences between prints of the réseau and the réseau itself.

(3) Examination of the straightness of the réseau lines.

As the declinations of Eros are not very important for parallax, only the errors in x have so far been investigated.

The numerical values of the errors given in this paper are for the scale of the Astrographic telescope ($1^{mm} = 1'$). They must be halved before being applied to the Thompson photographs. The réseau was printed on both sets of photographs at the same time and in precisely the same manner, the object-glass of the Astrographic telescope being used to give a beam of parallel rays.

The micrometer used throughout was described in *M.N.*, vol. liii. p. 326, but has been somewhat modified since then. Two microscopes, whose distance apart can be adjusted, are connected by a bar which can move longitudinally in a slide. The réseau and scale (or photographic plate) to be compared are carried in a large frame, so as to be viewed one by each microscope. The frame can move in a slide perpendicularly to the line joining the microscopes. A fixed wire in the right-hand microscope is set on the required scale division (or other mark) by moving the bar which carries the two microscopes, by means of a slow-motion screw. A movable wire in the left-hand microscope is then set on the required réseau-line by turning a micrometer-head. In order that the same reading of the micrometer may always correspond to the same distance between the two points viewed, however the slides are moved, it is necessary that either the axes of the microscopes should be parallel, or that each slide should move accurately in its plane. Probably an appreciable error arises from the non-fulfilment of these conditions when the outer parts of the réseau are viewed; the error can be detected and eliminated by turning the réseau through 180° and re-measuring. It seems to be inappreciable within the area between lines 9 and 19.

(1) *Corrections to the adopted division errors of lines 13, 14, 15 on the silver réseau.*

In the original determination the division errors of lines 8, 14, and 20, referred to 2 and 26, were first determined (along $y = 14$) by comparing the intervals, 2–8, 8–14, 14–20, 20–26, with the

same interval on a glass scale. The errors of the intermediate lines were then determined by the symmetrical method explained in the Introduction to the Astrographic Catalogue, vol. i. p. xxxvii.

In the re-determination, the object aimed at was to refer, with the greatest accuracy attainable, the central lines on which the place of Eros depends to the means of the lines used for reference or comparison stars, 4 to 24 or 9 to 19 respectively. With this object the interval between line 14 and each pair of lines from 4 to 24 was compared by means of the glass scale at $y = 13{\cdot}5$ and $y = 14{\cdot}5$, so that line 14 was referred in succession to the pairs of lines 4, 24; 5, 23; 6, 22 . . . . 13, 15, giving, after application of the provisional divisional errors, ten independent determinations of the division error of line 14 referred to a pair of lines. Similarly, line 13 was referred to each pair of lines 3, 23; 4, 24 . . . . 12, 14 and line 15 to each pair 5, 25; 6, 24 . . . . 14, 16. Since, in this method, each line is necessarily referred to pairs of lines symmetrically situated about itself, lines 13 and 15 could not be referred exactly to the same lines (4 to 24) as line 14, but it is clear that the accidental residual division error arising from the substitution of line 3 for line 24, and line 25 for line 4, in the two cases respectively, is negligible in the means of 20 lines.

The investigation was carried out at $y = 13{\cdot}5$ and $y = 14{\cdot}5$ independently. The accompanying table gives the result.

Table I.—Corrections to Provisional Division Errors.

$x=13$.			$x=14$.			$x=15$.		
Referred to Lines.	Correction. $y=13{\cdot}5$.	$y=14{\cdot}5$	Referred to Lines.	Correction. $y=13{\cdot}5$	$y=14{\cdot}5$	Referred to Lines.	Correction. $y=13{\cdot}5$.	$y=14{\cdot}5$.
	″	″		″	″		″	″
3, 23	+ ·003	− ·042	4, 24	+ ·087	+ ·029	5, 25	+ ·029	+ ·032
4, 22	+ ·026	·000	5, 23	+ ·063	+ ·004	6, 24	+ ·016	+ ·031
5, 21	− ·004	+ ·018	6, 22	+ ·025	+ ·046	7, 23	− ·008	+ ·002
6, 20	− ·015	− ·014	7, 21	+ ·004	+ ·001	8, 22	− ·031	+ ·015
7, 19	+ ·021	+ ·028	8, 20	− ·011	− ·034	9, 21	− ·048	+ ·008
8, 18	− ·027	− ·045	9, 19	+ ·004	− ·001	10, 20	− ·047	+ ·014
9, 17	− ·009	− ·035	10, 18	+ ·006	+ ·016	11, 19	− ·029	+ ·005
10, 16	− ·020	+ ·010	11, 17	− ·046	− ·029	12, 18	− ·042	− ·005
11, 15	− ·024	− ·018	12, 16	− ·011	− ·005	13, 17	− ·031	+ ·044
12, 14	− ·033	− ·027	13, 15	+ ·016	− ·001	14, 16	− ·025	+ ·003
Means 3 to 23	− ·008	− ·013	4 to 24	+ ·014	+ ·003	5 to 25	− ·022	+ ·015
Means 8 to 18	− ·023	− ·023	9 to 19	− ·006	− ·004	10 to 20	− ·035	+ ·012

The two sets of means given are the additional division errors applicable to Eros when referred to reference and comparison stars respectively on Astrographic photographs.

It will be noticed that line 15 has a considerable bend (″·04) in passing from $y = 13\frac{1}{2}$ to $14\frac{1}{2}$, whereas lines 13 and 14 are sensibly straight.

(2) *Systematic differences between the réseau and photographs.*

Fifteen plates were selected so as to be well representative of the different batches of Eros plates. These were one by one compared with the silver réseau; the corresponding lines on plate and réseau being compared at $y = 13{\cdot}5$ and at $y = 14{\cdot}5$. All the x lines from 3 to 25 were measured on each plate; a selection from the results is given in Tables II. and III. The errors tabulated are referred to the means of lines 9 to 19 as zero. They are differences between the prints and the silver réseau, and consequently are additional to the errors of the réseau itself. A linear term (corresponding to an apparent difference in scale between the plate and réseau) has been removed from the results for each plate. This is necessary if the plate constants a and e, found with the originally adopted errors, are not to be modified. This correction for scale is given in the last column of the tables for ten réseau intervals as applied to line 4, and with reversed sign to line 24, and proportionately to the other lines, and has been applied in forming the results given. It was determined by comparing the mean of lines 3 to 13 with the mean of lines 15 to 25, giving equal weight to each line, to correspond with the system adopted in forming the plate constants.

TABLE II.—COMPARISON OF PHOTOGRAPHIC PRINTS WITH RÉSEAU AT $y = 13{\cdot}5$

Plate No.	3	4	12	13	14	15	16	24	25	Corr. for Scale.
	″	″	″	″	″	″	″	″	″	″
5160	−·13	−·08	−·01	−·01	−·02	−·02	−·03	·00	−·21	+·08
5172	−·11	−·06	−·05	·00	−·02	−·03	−·01	+·01	−·20	+·16
5183	+·14	+·14	−·06	−·10	−·06	−·04	·00	+·26	+·04	+·31
5190	·00	·00	−·05	−·04	−·04	·00	−·03	−·01	−·27	+·02
5204	−·10	−·02	+·02	·00	−·01	−·08	−·06	+·21	−·05	+·11
5218	−·19	−·09	+·02	−·07	−·05	−·05	·00	−·07	−·20	+·16
5230	−·09	−·05	+·02	−·03	−·05	−·07	+·04	+·02	−·11	+·11
5239	−·09	−·01	−·01	−·02	−·02	−·07	+·02	+·09	−·15	+·01
5260	−·03	+·01	+·02	−·05	−·04	+·04	+·03	+·03	−·05	+·03
5283	+·11	+·12	−·05	−·05	−·04	−·07	−·01	+·13	−·01	−·04
5307	−·39	−·08	−·03	−·04	−·06	−·02	−·05	+·01	−·20	+·07
5324	−·72	−·39	+·03	−·02	−·07	−·06	−·13	−·08	−·36	+·27
5336	−·08	−·06	+·06	−·05	−·04	−·05	−·03	+·08	−·08	+·04
5352	−·33	−·18	+·03	−·06	−·08	−·11	−·06	−·01	−·22	+·12
5368	+·42	+·36	−·03	−·06	−·04	·00	+·07	+·27	+·05	−·20

TABLE III.—COMPARISON OF PHOTOGRAPHIC PRINTS WITH RÉSEAU AT $y = 14{\cdot}5$.

Plate No.	3	4	12	13	14	15	16	24	25	Corr. for Scale.
	″	″	″	″	″	″	″	″	″	″
5160	−·12	−·04	+·09	−·05	−·06	−·02	+·01	−·05	−·21	+·10
5172	−·13	−·09	+·05	−·10	−·07	−·07	+·05	−·07	−·23	+·19
5183	+·08	+·08	−·08	−·06	−·06	−·04	·00	+·20	+·04	+·32
5190	−·02	+·04	+·02	−·09	−·04	+·01	+·03	−·07	−·33	+·06
5204	−·17	−·07	+·10	−·06	−·03	−·04	−·03	+·12	−·06	+·12
5218	−·12	−·12	+·01	−·03	−·08	−·01	−·03	+·04	−·08	+·12
5230	−·12	−·11	+·08	−·11	−·02	−·01	+·06	·00	−·22	+·07
5239	−·07	−·07	−·01	−·06	−·05	−·03	−·04	+·03	−·11	+·01
5260	−·05	+·05	+·03	+·01	−·06	·00	·00	−·04	−·09	+·01
5283	+·06	+·13	+·01	−·12	−·04	−·05	+·02	+·09	+·01	−·06
5307	−·39	−·15	+·02	−·12	−·09	−·04	+·03	−·08	−·25	+·07
5324	−·64	−·43	+·04	−·07	−·04	−·03	−·02	−·07	−·29	+·28
5336	−·17	−·11	+·05	−·04	−·03	−·04	−·01	+·02	−·05	+·08
5352	−·31	−·19	+·02	−·07	−·09	−·07	+·02	−·03	−·20	+·13
5368	+·39	+·38	−·02	−·15	−·06	−·01	+·06	+·23	+·03	−·16

TABLE IV.—COMPARISON OF PHOTOGRAPHS WITH RÉSEAU.

	MEAN ERRORS OF 15 PHOTOGRAPHS.					
x	y, 13·5	y, 14·5	x	y, 13·5	y, 14·5	Probable Error.
	″	″		″	″	″
3	−·106	−·119	25	−·135	−·136	±·028
4	−·026	−·047	24	+·063	+·021	±·022
5	+·017	−·004	23	+·043	+·017	±·016
6	−·026	+·029	22	+·007	+·003	±·013
7	−·003	+·011	21	−·029	+·030	±·011
8	+·056	+·040	20	−·001	+·007	±·011
9	+·029	+·027	19	+·015	+·016	±·009
10	+·023	+·030	18	+·035	+·008	±·007
11	+·021	+·038	17	+·020	+·011	±·006
12	−·006	+·027	16	−·017	+·010	±·007
13	−·040	−·075	15	−·042	−·030	±·005
14	−·043	−·055	14	−·043	−·055	±·004

The mean differences between the réseau and its prints, derived from the fifteen prints examined, are given in Table IV., together with the probable errors of the values found (deduced from the mean discordances of the fifteen prints for each pair of lines). It will be seen that, far from being accurate reproductions of the réseau, the prints differ from it very considerably. Near the

centre the prints agree very closely among themselves. The mean discordance of the measured position of a line *on a single print* from the mean print ranges from ±″·016 for line 14 to ±″·04 for lines 9 and 19, and to ±″·13 for the extreme lines 3 and 25, increasing regularly with the distance from the centre. The great variability of the outside lines is mainly due to the method by which the scale correction was found. That the irregularity is not entirely arbitrary can be very well seen by examining the differences between the errors of lines 24 and 25 in Tables II. and III. Whereas the absolute errors vary greatly from print to print, the differences are very accordant.

The correction to the place of Eros derived from Table IV. is very considerable. If it is not applied there will be an apparent spurious parallactic displacement of Eros amounting to about 0″·1 between east and west positions, and an error of at least ″·025 in the final value of the solar parallax, deduced from the Astrographic photographs.

(3) *Examination of the Straightness of the Lines.*

So far, all measurements described have been confined to the strip of the réseau near $y = 14$, and the result enables Eros to be accurately referred to stars distributed over this strip. But this strip may in the mean have an error relative to the area covered by the reference and comparison stars. If the ruling machine is not absolutely accurate, a curvature of all the réseau lines may exist. Previous investigation had shown that if such a curvature exists at all it must be very small, but it might not be negligible in the present problem.

The straightness was tested by comparing the lines directly with a spider web mounted parallel to them in the double frame of the micrometer as for the comparisons of the réseau and photographic plate. Sir David Gill has described a somewhat similar comparison with a spider line (*Memoirs R.A.S.*, vol. 51), though in that case the réseau line could not be compared directly with the spider-line, as was practicable with the Greenwich measuring apparatus.

In order to eliminate irregularities due to "knots" in the spider line, measures were repeated with the spider line turned over front to back. A more serious error (which was attributed to the slide which carries the spider-line and réseau not moving perfectly in its own plane) could only be eliminated by turning the réseau through 180° and measuring again.*

Experiments were made both on the prints and the réseau

* When the réseau is turned through 180° the curvature or other irregularities measured against the spider-line will be reversed in direction; instrumental errors will be unaltered. The instrumental error associated with, say, $y = 9$ réseau direct will be associated with $y = 19$ réseau reversed, so that the instrumental error will not be eliminated from the individual points, but from the means of pairs of points such as $y = 9$ and 19, and from the mean curvature.

itself. For the réseau the investigation was almost entirely confined to line $x = 14$, since it happened to be impracticable (without modifying the micrometer) to measure any other line both in the direct and reversed position. Four sets of measures were made at different times, and the following table gives the results.

TABLE V.—CURVATURE OF RÉSEAU LINE $x = 14$.

(*Sagitta for* $y = 5$ *to* 23.)

	Series.	1	2	3	4
		″	″	″	″
Réseau D Wire D		·000	− ·030	− ·022	− ·046
,, D ,, R		...	− ·034	− ·074	− ·030
,, R ,, D		− ·068	...	+ ·014	+ ·002
,, R ,, R		...	...	+ ·006	+ ·006
	Means	− ·034	− ·032	− ·019	− ·017

In this table the "curvature" has been measured by the discordance between the middle of the line (represented by the mean of $y = 12, 13, 14, 15, 16$) and the line joining the two ends (represented by the means of $y = 4, 4\frac{1}{2}, 5, 5\frac{1}{2}, 6$, and $y = 22, 22\frac{1}{2}$ $23, 23\frac{1}{2}, 24$). As the réseau was not reversed in Series No. 2, instrumental error is not eliminated from the corresponding mean.

In examining the *photographed* lines the treatment was somewhat different. The aim of the investigation was to obtain the mean error of the central strip with reference to the areas covered respectively by the reference and comparison stars. Eight plates were selected (from the fifteen previously referred to) and measured according to the following scheme. It must be remembered that lines 1 to 13 could only be measured with the réseau direct, and lines 15 to 27 with the réseau reversed.

Straightness of Lines on Prints, Scheme of Measures.

Plate.	Date. 1900.	Réseau Lines. x.	Prints.	Spider Line.
5172	Oct. 20	4, 6, 8, 10, 12, 14	Direct	Reversed
5190	,, 26	14, 16, 18, 20, 22, 24	Reversed	Direct
5204	,, 28	4, 6, 8, 10, 12, 14	Direct	Direct
5218	Nov. 10	14, 15, 17, 19, 21, 23	Reversed	Reversed
5239	,, 15	14, 16, 18, 20, 22, 24	Reversed	Reversed
5260	,, 22	5, 7, 9, 11, 13, 14	Direct	Reversed
5307	Dec. 15	14, 15, 17, 19, 21, 23	Reversed	Direct
5352	Jan. 8	5, 7, 9, 11, 13, 14	Direct	Direct

Measures were made at $y = 9\frac{1}{2}, 10\frac{1}{2}, 11\frac{1}{2}, 12\frac{1}{2}, 13\frac{1}{2}, 14\frac{1}{2}, 15\frac{1}{2}$, $16\frac{1}{2}, 17\frac{1}{2}$, and $18\frac{1}{2}$, and also at either $4\frac{1}{2}, 5\frac{1}{2}, 22\frac{1}{2}, 23\frac{1}{2}$, or $6\frac{1}{2}, 7\frac{1}{2}$, $20\frac{1}{2}, 21\frac{1}{2}$.

Within the area covered by the comparison stars the irregularities appear to be simply accidental. Table VI. shows the results for this area. The means of the vertical columns are made zero. The smallness of the horizontal means seems to show that within this area there is no appreciable error of the ruling machine. The mean deviation from straightness (including error of measurement and accidental error of the prints examined) is $\pm''\cdot 024$.

The mean error of the central strip referred to the square 9 to 19* is found (from Table VI.) to be $-''\cdot 006 \pm''\cdot 005$, a quantity which is almost negligible even for parallax.

In the larger area occupied by the *reference stars* curvature is sensible. For line 14 it amounts to $-''\cdot 048$ (measured by the sagitta from 5 to 23), which may be compared with the results for the silver réseau given in Table V. The results for the other lines cannot be given separately, since instrumental error was only eliminated from their mean. The mean curvature of all the even lines from $x=4$ to $x=24$ (measured in the same way) is $-''\cdot 020$.

It may legitimately be asked whether, in spite of all precautions, the errors determined in the foregoing investigations and the accuracy claimed for the values found may not be to some extent illusory. Is it quite certain that all instrumental errors have been eliminated? Is it certain that there may not be other sources of division error which have not been considered? Fortunately a discussion of the residuals of the comparison and reference stars supplies an independent check on the results obtained by direct measurement. Before the measurements of the réseau and its prints were made, it was realised that considerable corrections were required in order to reconcile the places of the stars determined with the telescope west and east respectively. The plate centre was the same for all plates taken on any one night (evening and morning); if on the evening photographs the image of a star falls at $x=12$ $y=10$, on the morning photographs (with the réseau reversed) it will fall at $x=16$ $y=18$. It can be shown that the difference in the places of the star determined from the two sets of photographs should be equal to the sum of the residual division errors of these two points of the réseau.

An examination of the places of the stars was made for all nights on which at least two plates were taken with the telescope in each position. There were 14 nights thus available; the number of comparison stars discussed was 73, and of reference stars 146. The comparison stars were referred to the mean of the comparison stars on the plate; accordingly the division errors

* It will be seen that the square 9 to 19 is represented by 110 points evenly distributed over it, each measured on at least two prints.

TABLE VI.—TEST OF STRAIGHTNESS OF RÉSEAU LINES ON PRINTS.

y \ x	Plate Direct. 9	10	11	12	13	14	Plate Reversed. 14	15	16	17	18	19	Mean.
$18\frac{1}{2}$	+″·01	+″·05	−″·01	″·00	+″·02	+″·02	″·00	−″·01	−″·04	″·00	−″·06	−″·02	−″·005
$17\frac{1}{2}$	−·01	+·02	+·02	−·02	+·01	+·01	−·01	−·03	−·03	+·03	+·02	−·06	−·004
$16\frac{1}{2}$	−·01	−·01	−·03	−·02	−·01	−·01	−·01	−·05	·00	−·05	+·01	−·04	−·021
$15\frac{1}{2}$	+·01	+·02	+·03	−·01	−·01	−·03	−·03	·00	+·05	+·01	+·01	−·01	+·008
$14\frac{1}{2}$	−·02	−·07	−·03	+·02	−·01	−·01	−·02	+·01	+·01	−·06	+·01	−·01	−·015
$13\frac{1}{2}$	−·05	·00	+·01	−·03	−·01	·00	+·01	·00	+·04	+·04	+·02	·00	+·003
$12\frac{1}{2}$	·00	+·01	+·02	−·03	+·01	−·02	+·01	+·06	+·03	+·01	−·01	+·02	+·012
$11\frac{1}{2}$	+·03	+·02	−·01	+·03	+·04	·00	−·01	·00	−·02	+·02	·00	+·06	+·016
$10\frac{1}{2}$	+·03	−·03	·00	+·03	−·03	+·03	+·02	+·03	−·03	+·02	−·01	+·02	+·007
$9\frac{1}{2}$	+·01	−·02	·00	+·02	·00	+·03	+·02	−·01	−·01	−·03	·00	+·03	+·001

The two sets of errors for line 14 are derived from plates measured direct and reversed respectively.

deduced are referred to the square 9 to 19. The reference stars similarly give division errors referred to the square 4 to 24.

Sums of Pairs of Residual Division Errors.

Comparison Stars (*from* $y=9$ *to* $y=19$).

$x=$	9, 19	10, 18	11, 17	12, 16	13, 15	14,14
From stars	+″·04	+″·01	+″·06	″·00	−″·10	−″·09
By direct measurement (Table IV.)	+·04	+·05	+·04	+·01	−·11	−·10

Reference Stars (*from* $y=4$ *to* $y=24$).

$x=$	5, 23	7, 21	9, 19	11, 17	13, 15
From stars	+″·08	+″·05	+″·04	−″·04	−″·11
By direct measurement (deduced from Table IV.)	+·03	+·03	+·06	+·04	−·08

In the latter table by the division error about line 5 is meant the mean division error between 4 and 6; similarly for the other lines. The division error has been regarded as independent of y, so that all stars between the given limits of x were used.

Fifteen comparison stars fall in the strip bounded by $y=13$ and 15 $x=9$ and 19. After correcting their residuals for the revised division errors which depend on x (Table IV.), the remaining differences (between their positions determined from plates with réseau direct and reversed) should be equal to twice the error of the strip referred to the whole square. In this way we find from the mean of the fifteen stars the error $-″·02 \pm ″·006$, which may be compared with the direct determination (by use of the spider-line) $-″·006 \pm ″·005$.

The probable error $\pm ″·006$ of the result given above was inferred from the discordances *inter se* of the residuals for the fifteen stars. The mean discordance of these is $\pm ″·05$, which represents usually Mean of two plates W. − Mean of two plates E., and the apparent correction W. or E. is half this quantity. It results that the mean error of measurement on a single plate is $\pm ″·05$ for a comparison star. The error of measurement for a reference star (over the wider field) is apparently much larger.

Royal Observatory, Greenwich:
1907 *January* 11.

Note on the Determination of the Wire-Intervals for a Transit Instrument. By W. H. M. Christie.

In the ordinary use of a transit instrument, the transits of stars are observed over the whole system of wires (say 9 or more), and the instrumental errors (collimation in particular) are referred to the central wire, so that the wire-intervals are required mainly to refer the mean of the wires to the central wire with a high degree of accuracy.

A ready method of doing this independently of star transits is to compare the direct and reflected images of each pair of wires (reckoned from the centre), the small asymmetry of each pair, relatively to the central wire, being measured by the micrometer.

Thus, with a system of 9 wires, the observations would be arranged as follows:—

Wire.	Wire.	Wire.	Wire.
1D 9R	5D 5R	5D 5R	9D 1R
2D 8R	5D 5R	5D 5R	8D 2R
3D 7R	5D 5R	5D 5R	7D 3R
4D 6R	5D 5R	5D 5R	6D 4R

—the reflected image in each case being brought into coincidence (or contact on alternate sides) with the direct image.

Thus the interval between the central wire and the mean of the other 8 wires is determined with the full weight of eight observations; and as the distances between the direct and reflected images of the pairs of wires are very small, the result is practically independent of errors of the micrometer screw. A moderate number of determinations made in this way should suffice to reduce complete transits to the central wire.

For incomplete transits of quick-moving stars, the interval of each wire from the centre wire is required with an accuracy which should be several times greater than that of a single observation, any error in the adopted wire-interval being in this case accidental, and not systematic. A few transits of close circumpolars, or a very moderate number of transits of quick-moving stars, would amply suffice for this.

For close circumpolar stars observed on wires other than the centre wire, it would, of course, be necessary to determine the wire-interval from the centre wire with an accuracy considerably exceeding that of the observation; and for such cases, when they occur, special provision would have to be made.

The great bulk of transits observed would be covered by the method explained above.

Royal Observatory, Greenwich:
1907 *January* 10.

The Places of Zodiacal Stars for the Epoch 1900.

By A. M. W. Downing, D.Sc., F.R.S.

Some years ago the project was formed of constructing a catalogue of zodiacal stars, from all available sources, that would serve, for a decade or so, for such purposes as the supply of sufficiently accurate places of a large number of stars liable to occultation by the Moon, and of stars suitable as Moon-culminators. This catalogue (hereinafter called the Zodiacal Catalogue) was published in its completed form in 1905, as vol. viii. part iii. of the *Astronomical Papers of the American Ephemeris and Nautical Almanac*, under the title of "Catalogue of Zodiacal Stars for the Epochs 1900 and 1920, reduced to an absolute system." As it is fairly complete to magnitude 7·0, and contains a good many stars fainter than 7·0, the catalogue, as thus described, may appear to be rather an ambitious undertaking. Accordingly, I have been glad to avail myself of the opportunity offered by the publication of the *Cape General Catalogue for* 1900 (part i. of which gives the places of 1265 of our 1607 zodiacal stars) to utilise it for the purpose of checking the general accuracy of the Zodiacal Catalogue at the initial epoch.

The Zodiacal Catalogue is reduced to the system of Newcomb's Fundamental Catalogue, and contains all the suitably placed stars in the latter (211 in number), with their places unchanged. The Cape Catalogue is also reduced to Newcomb's system, both in right ascension and in declination, and, in addition, the right ascensions are corrected for personality depending on magnitude. As the Cape places are printed without inclusion of the proper motions, I have applied, in all cases, the effects of the proper motions given in the Zodiacal Catalogue to the Cape places. Only some 50 stars in the Zodiacal Catalogue have no proper motions assigned to them.

It was decided to reject differences between the catalogues amounting to, or greater than, $0^s{\cdot}2$ in right ascension and $3''$ in declination. The adoption of this criterion resulted in the exclusion of 8 right ascensions and 3 declinations of the Zodiacal Catalogue from the comparison. No Newcomb star has been excluded. A case of discordance in the right ascension of β *Virginis* was traced to an error in the Cape Catalogue, where the seconds of right ascension should be $29^s{\cdot}274$, in place of $29^s{\cdot}082$.

The means of the residuals without regard to sign for three hourly groups of catalogue differences, taken at random, are then found to be $^s{\cdot}030$ and $''{\cdot}45$ in right ascension and declination respectively for the complete comparison, including the Newcomb stars; and $^s{\cdot}019$ and $''{\cdot}31$ in right ascension and declination for the Newcomb stars.

The differences between the catalogue places have been combined in groups extending over one hour of right ascension. As the stars here dealt with are all ecliptic stars, it is not possible to separate discordances depending on right ascension from those depending on

declination. The mean declination corresponding to the middle of each hour of right ascension has accordingly been entered in Table I. This table gives the mean differences in right ascension and declination of the Zodiacal Catalogue (including the Newcomb stars) *minus* Cape in the columns headed I., and the corresponding mean differences Newcomb *minus* Cape in the columns headed II. The subscript figures are the numbers of stars occurring in each group.

As before mentioned, the Cape right ascensions are corrected for personality depending on magnitude. The effect of this is apparent in the relative values of the mean differences of the columns I. and II., under the heading $\Delta\alpha$. The mean magnitude of the stars discussed in column I. is about 6; that of the stars discussed in column II. is 4 or 4·5. As the right ascensions of stars of the fainter magnitudes have a relative correction of the negative sign applied to them in the Cape Catalogue, the difference of the means is thus accounted for. The outstanding differences occurring in column I. under $\Delta\alpha$, as well as those under $\Delta\delta$, must be ascribed to the effect of the presence of the fainter stars with proper motions of inferior accuracy to those of the stars included in the columns headed II. It will be remarked, however, that there is considerable uncertainty in the values of the individual groups in the columns headed II., arising from the comparatively small number of stars in each group.

In Table II. the same groups of differences are combined in pairs and arranged in order of declination, so as to exhibit any possible variation depending on that element. In Table III. the readings of the interpolating curves, drawn through the points representing the mean differences of Table I., are given for the beginning of each hour of right ascension, and the corresponding degree of declination on the ecliptic.

It appears from this discussion that (assuming the errors of the Cape places to be relatively insignificant) the places of the Zodiacal Catalogue for 1900 may be relied upon to within quite narrow limits for the great majority of the stars contained therein. Normally, these limits should not exceed $^{s}\cdot1$ in right ascension and $1''\cdot5$ in declination, even in unfavourable cases, as may be inferred from the values of the means of the residuals cited above.

But we now require the places of these stars for 1910, and must allow a slightly wider margin of error for that epoch, and, from it, up to the terminal epoch of the catalogue. The average variations from the Cape observations, with which they have been here compared, are not conspicuously more irregular, at the epoch 1900, for the fainter stars than for those occurring in Newcomb's Fundamental Catalogue.

[Tables.

Table I.

α,	δ.	$\Delta\alpha$. I.	$\Delta\alpha$. II.	$\Delta\delta$. I.	$\Delta\delta$. II.
h h	°	s	s	″	″
0– 1,	+ 3	+ ·023$_{50}$	+ ·007$_{12}$	+ ·22$_{50}$	+ ·26$_{12}$
1– 2,	+ 9	+ ·017$_{48}$	+ ·009$_{8}$	+ ·17$_{49}$	+ ·20$_{8}$
2– 3,	+ 15	+ ·010$_{49}$	+ ·011$_{10}$	+ ·09$_{49}$	− ·05$_{10}$
3– 4,	+ 19	+ ·026$_{55}$	+ ·009$_{9}$	− ·09$_{56}$	+ ·02$_{9}$
4– 5,	+ 22	+ ·012$_{72}$	+ ·004$_{12}$	+ ·17$_{72}$	− ·05$_{12}$
5– 6,	+ 23	+ ·015$_{61}$	+ ·012$_{4}$	+ ·05$_{60}$	− ·07$_{4}$
6– 7,	+ 23	+ ·013$_{58}$	− ·003$_{6}$	+ ·28$_{59}$	+ ·08$_{6}$
7– 8,	+ 22	+ ·015$_{51}$	+ ·012$_{11}$	+ ·08$_{51}$	+ ·07$_{11}$
8– 9,	+ 19	+ ·009$_{43}$	+ ·007$_{10}$	− ·01$_{43}$	− ·29$_{10}$
9–10,	+ 15	+ ·019$_{40}$	− ·005$_{10}$	+ ·01$_{41}$	+ ·03$_{10}$
10–11,	+ 9	+ ·024$_{44}$	·000$_{9}$	+ ·09$_{45}$	+ ·01$_{9}$
11–12,	+ 3	+ ·035$_{47}$	+ ·008$_{10}$	+ ·08$_{47}$	+ ·29$_{10}$
12–13,	− 3	+ ·043$_{47}$	+ ·010$_{5}$	+ ·11$_{46}$	− ·08$_{5}$
13–14,	− 9	+ ·023$_{48}$	− ·005$_{6}$	+ ·06$_{48}$	+ ·03$_{6}$
14–15,	− 15	+ ·032$_{47}$	− ·001$_{11}$	+ ·13$_{47}$	− ·11$_{11}$
15–16,	− 19	+ ·032$_{55}$	+ ·006$_{10}$	+ ·21$_{55}$	+ ·11$_{10}$
16–17,	− 22	+ ·050$_{61}$	+ ·006$_{6}$	+ ·26$_{61}$	− ·02$_{6}$
17–18,	− 23	+ ·037$_{56}$	− ·017$_{7}$	+ ·05$_{57}$	− ·13$_{7}$
18–19,	− 23	+ ·029$_{62}$	− ·004$_{7}$	+ ·09$_{62}$	− ·09$_{7}$
19–20,	− 22	+ ·033$_{59}$	+ ·006$_{10}$	+ ·10$_{60}$	+ ·07$_{10}$
20–21,	− 19	+ ·032$_{48}$	+ ·008$_{8}$	+ ·14$_{47}$	+ ·08$_{8}$
21–22,	· 15	+ ·015$_{53}$	− ·010$_{10}$	− ·09$_{53}$	− ·16$_{10}$
22–23,	− 9	+ ·019$_{49}$	− ·002$_{7}$	+ ·09$_{50}$	− ·12$_{7}$
23–24,	− 3	+ ·033$_{54}$	+ ·008$_{13}$	+ ·14$_{54}$	+ ·11$_{13}$
Means		+ ·0250$_{1257}$	+ ·0034$_{211}$	+ ·103$_{1262}$	+ ·017$_{211}$

Table II.

δ.	$\Delta\alpha$. I.	$\Delta\alpha$. II.	$\Delta\delta$. I.	$\Delta\delta$. II.
+ 23°	s + ·014$_{119}$	s + ·005$_{10}$	+ ″·17$_{119}$	+ ″·01$_{10}$
+ 22	+ ·014$_{123}$	+ ·008$_{23}$	+ ·13$_{123}$	+ ·02$_{23}$
+ 19	+ ·018$_{98}$	+ ·008$_{19}$	− ·05$_{99}$	− ·14$_{19}$
+ 15	+ ·015$_{89}$	+ ·003$_{20}$	+ ·05$_{90}$	− ·01$_{20}$
+ 9	+ ·021$_{92}$	+ ·005$_{17}$	+ ·13$_{94}$	+ ·11$_{17}$
+ 3	+ ·029$_{97}$	+ ·008$_{22}$	+ ·15$_{97}$	+ ·28$_{22}$
− 3	+ ·038$_{101}$	+ ·009$_{18}$	+ ·13$_{100}$	+ ·02$_{18}$
− 9	+ ·022$_{97}$	− ·004$_{13}$	+ ·08$_{98}$	− ·05$_{13}$
− 15	+ ·024$_{100}$	− ·006$_{21}$	+ ·02$_{100}$	− ·14$_{21}$
− 19	+ ·032$_{103}$	+ ·007$_{18}$	+ ·18$_{102}$	+ ·10$_{18}$
− 22	+ ·042$_{120}$	+ ·006$_{16}$	+ ·18$_{121}$	+ ·03$_{16}$
− 23	+ ·033$_{118}$	− ·011$_{14}$	+ ·07$_{119}$	− ·11$_{14}$

TABLE III.

α,	δ.	$\Delta\alpha$. I.	$\Delta\alpha$. II.	$\Delta\delta$. I.	$\Delta\delta$. II.
h	°	s	s	″	″
0,	0	+·026	+·008	+·17	+·13
1,	+ 6	+·020	+·007	+·18	+·18
2,	+12	+·016	+·010	+·10	+·08
3,	+17	+·018	+·010	+·03	−·01
4,	+21	+·018	+·007	+·04	−·04
5,	+23	+·016	+·006	+·11	−·05
6,	+23	+·016	+·004	+·16	·00
7,	+23	+·016	+·004	+·14	+·01
8,	+21	+·015	+·006	+·06	−·07
9,	+17	+·013	+·002	·00	−·10
10,	+12	+·019	−·001	+·02	·00
11,	+ 6	+·028	+·004	+·08	+·12
12,	+ 0	+·036	+·009	+·10	+·10
13,	− 6	+·033	+·001	+·10	·00
14,	−12	+·030	·000	+·10	−·03
15,	−17	+·033	·000	+·18	·00
16,	−21	+·039	+·002	+·22	+·02
17,	−23	+·042	−·003	+·17	−·07
18,	−23	+·037	−·008	+·10	−·08
19,	−23	+·032	−·001	+·09	−·02
20,	−21	+·030	+·005	+·09	+·02
21,	−17	+·023	+·001	+·03	−·01
22,	−12	+·020	−·003	+·02	−·10
23,	− 6	+·024	+·002	+·09	−·02

Micrometrical Measures of Double Stars (Fourth Series). By the Rev. T. E. Espin.

The stars measured in 1906 have been mainly those of *h*. In the list of these measures which is here given an asterisk against the number of the star denotes that the object observed is not exactly in the place given by *h*, and the difference is then given in the notes. The following stars I have not so far succeeded in identifying:—

		h m s		
h 5455	*h*'s place	2 49·14	N.P.D. 58°·10′ (1830)	1906 Nov. 13
h 339		3 49·15	58·10	1906 Nov. 30
h 340		3 56· 7	58· 0	1906 Nov. 30
h 2593		11 51·54	49·10	1906 April 10, 21
h 2670		13 32·50	56·16	1906 April 9, 10
h 995		23 49·26	62·17	1906 Oct. 13, 16

h.	R.A. 1900. h m	Decl. 1900. ° ′	P. °	D. ″	Mags.	Date. 1900+.	Nights.
5450	0 6·7	+35 35	232·6	4·75	9·1, 13·0	6·87	2
622	0 20·6	+34 14	131·3	18·22	9·0, 9·0	4·78	2
1032	0 26·7	+28 58	246·3	12·29	8·3, 9·0	6·80	2
625	0 30·4	+39 43	282·9	14·38	8·9, 14·0	6·71	2
629	0 50·1	+34 1	69·3	10·38	8·5, 11·5	6·86	2 BC
			74·3	71·26	A= 8·5	6·86	2 AB
631	1 59·5	+27 27	156·9	21·92	8·8, 11·0	6·90	2
636	1 8·8	+30 0	287·5	20·57	7·7, 11·0	6·84	3
1078	1 18·9	+27 3	89·8	15·18	8·5, 11·5	6·87	2 AB
			89·7	28·34	C= 10·0	6·87	2 AC
653	2 27·6	+30 58	40·9	22·99	7·8, 11·7	6·85	2
328	2 35·9	+36 3	245·5	13·07	9·5, 11·0	6·47	2
329	2 47·9	+31 18	106·0	35·41	8·0, 13·5	6·86	1
336	3 36·4	+32 37	316·2	31·68	8·0, 11·0	6·92	2 (Σ 432 rej.)
670	3 56·4	+31 53	226·8	10·50	9·5, 9·5	6·92	2
349	4 41·1	+34 35	85·6	9·87	9·1, 9·5	4·98	2
350	4 44·6	+34 37	308·1	5·50	10·7, 10·7	6·06	2
3265	5 1·3	+36 55	137·0	14·63	9·0, 9·0	6·13	2
3266	5 1·5	+36 52	61·7	8·05	9·0, 10·5	6·13	2
3272	5 13·2	+39 14	342·9	18·86	7·7, 13·0	6·09	2 AB
			296·4	27·31	C= 13·3	6·11	3 AC
			42·5	32·69	D= 11·5	6·13	2 AD
713	5 49·6	+33 15	285·0	10·10	8·9, 9·0	6·92	2
380	6 2·8	+34 29	21·8	18·67	9·0, 9·0	6·09	4
3282	6 20·8	+38 10	313·7	15·89	9·0, 12·2	6·04	2
3284	6 39·8	+36 17	84·8	5·42	10·2, 11·2	6·09	2

h.	R.A. 1900. h m	Decl. 1900. ° ′	P. °	D. ″	Mags.	Date. 1900+.	Nights.
3285	6 46·2	+38 15	252·6	11·11	9·6, 10·7	6·04	2
411	7 1·2	+35 22	43·8	9·40	...	6·11	2
757	7 16·2	+34 27	105·9	5·28	9·8, 10·5	6·09	2
3294	7 27·5	+35 51	178·0	4·81	9·4, 9·5	6·10	2
3295	7 31·3	+39 5	15·5	22·75	8·5, 10·0	6·04	3 (Σ 1118 rej.)
3301	7 43·8	+37 28	61·3	23·47	7·7, 13·7	6·07	3
3303	7 49·3	+35 46	34·3	12·05	9·4, 11·5	6·11	2
3305	7 54·4	+37 9	229·0	4·39	9·0, 9·0	6·06	2
772	7 55·3	+35 43	58·5	12·32	9·7, 13·0	6·14	1
436	7 57·1	+35 16	80·5	12·18	9·5, 11·5	6·11	2
3308	8 3·7	+35 46	265·3	46·01	6·2, 10·0	6·19	2
793	8 34·3	+35 29	254·1	10·25	9·0, 10·0	6·12	2
2483	9 5·6	+36 32	193·9	15·19	9·0, 10·0	6·11	3
2491	9 10·6	+34 56	200·4	14·21	10·2, 10·3	6·10	3
2493	9 13·7	+34 9	157·4	9·97	10·1, 11·7	6·14	2
462	9 17·2	+30 34	7·5	18·01	9·3, 9·6	6·27	2
463	9 17·5	+30 40	347·5	24·41	9·1, 10·5	6·27	2
815	9 24·0	+33 20	144·5	13·98	8·9, 13·0	6·24	3
2509	9 46·8	+37 41	68·5	14·02	...	6·25	2
471	9 49·9	+31 9	311·9	10·45	...	6·28	1
3318	9 57·7	+36 44	339·3	23·97	9·1, 9·5	6·14	2
475	10 3·1	+32 6	172·4	27·63	6·7, 14·0	6·27	2
2531	10 22·5	+40 43	2·6	8·74	8·9, 9·3	6·14	3
2532	10 23·7	+38 29	248·2	12·64	9·0, 9·0	6·11	2
482	10 26·2	+32 54	243·4	40·96	6·0, 12·0	6·27	2
483	10 26·3	+32 42	133·5	15·34	8·8, 10·8	6·27	2
2555	10 57·7	+39 7	45·2	11·22	10·0, 11·5	6·19	2
493*	10 58·2	+33 25	327·7	17·18	9·3, 10·8	6·27	2
499	11 22·8	+36 52	254·0	39·59	8·5, 11·7	6·23	3
500	11 26·5	+36 25	26·7	24·10	9·1, 9·2	6·23	3
502	11 28·3	+37 35	219·0	12·42	9·3, 12·0	6·21	2
506*	11 33·5	+39 45	143·5	28·38	7·0, 14·0	6·32	1
510	11 45·0	+38 16	251·7	24·86	9·6, 9·8	6·28	2
844*	12 3·1	+33 29	331·3	11·55	9·0, 10·0	6·30	1
2600	12 6·2	+33 50	341·5	11·41	9·9, 10·2	6·31	2
523	12 47·1	+35 19	183·3	14·41	9·1, 9·2	6·27	2
524	12 47·7	+32 28	288·9	17·87	9·2, 11·0	6·29	3
528	13 10·4	+40 16	179·9	18·75	9·1, 10·9	6·29	2
2681	13 42·3	+33 37	262·9	13·61	11·5, 12·0	6·28	2
587	14 36·3	+37 42	298·4	16·32	8·5, 11·5	6·57	1
263	14 57·9	+38 2	112·2	17·79	9·2, 11·5	6·60	2
1340	18 38·9	+32 25	82·2	13·09	9·2, 11·6	6·57	1
1379	19 9·2	+31 28	307·0	9·30	9·3, 11·2	6·69	2

h.	R.A. 1900. h m	Decl. 1900. ° ′	P. °	D. ″	Mags.	Date. 1900+.	Nights.
1383	19 15·4	+31 22	111·6	11·32	10·0, 10·0	6·64	3
1390	19 18·3	+30 42	131·9	9·44	9·3, 14·0	6·66	2 BC (new)
			100·9	16·94	A= 9·0	6·66	2 AB
1616	21 5·7	+30 36	292·8	8·58	8·9, 9·7	6·65	3
1686	21 40·1	+31 17	230·2	13·28	9·5, 10·1	6·59	2
1688*	21 43·5	+30 48	358·7	14·90	9·5, 11·0	6·69	2
1695	21 44·2	+30 47	116·1	13·07	9·0, 11·0	6·69	2
1707	21 52·0	+31 28	331·4	8·41	9·3, 11·0	6·67	2
1722	22 1·3	+31 26	45·7	16·72	8·9, 9·9	6·64	2
966	22 30·4	+30 17	268·3	13·27	7·0, 11·0	6·68	3 AB
			276·0	36·84	C= 12·0	6·66	2 AC
972	22 48·1	+31 8	193·9	23·99	8·8, 10·0	6·76	2
1834	22 53·3	+29 50	165·9	25·56	...	6·77	2
			4·2	27·94	C= 13·0	6·78	2 (new)
			270·2	58·21	...	6·78	3
1837	22 54·7	+29 33	349·4	19·06	8·6, 12·2	6·80	2
1839	22 55·8	+40 35	294·9	13·58	8·9, 10·3	5·96	2
1858	23 9·5	+29 11	84·1	24·88	8·9, 11·2	6·74	2
1859	23 9·5	+29 18	121·3	34·57	7·0, 10·5	6·74	2
1862	23 10·9	+26 56	233·9	16·79	8·5, 10·0	6·81	1

Various Stars.

Name.	R.A. 1900. h m	Decl. 1900. ° ′	P. °	D. ″	Mags.	Date. 1900+.	Nights.
S 386 ...	0 26·9	+27 57	196·6	42·02	8·8, 8·9	6·78	3
η Cassiopeiæ...	0 41·3	+57 17	233·8	5·68	...	6·08	3
Washburn 6...	1 30·2	+32 31	105·8	2·33	9·0, 9·0	6·07	4
B.D. +29°·330	1 50·7	+29 58	306·4	53·18	8·2, 9·2	6·86	2
B.D. +30°·303	1 51·3	+30 32	270·7	66·50	7·6, 9·0	6·89	2
Σ 187 rej. ...	1 51·8	+31 5	180·2	13·05	8·6, 11·0	6·81	2
15 Trianguli	2 29·7	+34 15	17·1	138·80	5·5, 7·0	6·91	1
Σ 568 rej. ...	4 31·5	+39 17	213·0	21·50	8·0, 11·0	5·02	1
Σ 594 rej. ...	4 42·5	+39 5	335·0	7·86	8·5, 10·0	6·03	1
S 484 ...	5 22·8	+33 25	170·7	59·20	...	6·91	1
Σ 842 rej. ...	6 2·1	+36 32	18·0	29·08	8·2, 9·6	6·55	2
Σ 1139 rej. ...	7 41·8	+37 21	6·9	15·95	8·6, 9·1	6·06	2
Σ 1294 rej. ...	8 51·1	+33 18	339·7	15·01	8·5, 9·0	6·08	2
Σ 1411 rej. ...	10 3·4	+32 50	306·7	35·11	9·0, 9·4	6·08	1
Σ 1492 rej. ...	10 52·1	+31 12	164·7	21·53	7·8, 9·7	6·29	2
Σ 1610 rej. ...	12 6·6	+39 21	330·5	28·93	7·9, 9·2	5·81	2
Σ 1739 rej. ...	13 16·9	+31 1	130·7	12·37	9·2, 10·0	6·31	2
Σ 1749 rej. ...	13 24·3	+31 35	350·0	20·51	8·5, 10·0	6·30	1
Σ 2295 ...	18 8·6	+31 32	171·7	9·62	8·5, 9·0	6·65	2

Name.	R.A. 1900. h m	Decl. 1900.	P.	D.	Mags.	Date. 1900+.	Nights.
A.G.C.	... 18 15·6	+29° 52′	172°·3	17″·91	9·0, 9·4	6·71	2
Σ 2359 rej.	... 18 34·7	+30 42	291·5	22·55	8·8, 12·0	6·65	1
A.G.C.	... 19 57·9	+31 23	355·8	12·15	8·3, 8·9	6·61	1
Ho 588	... 20 12·9	+31 12	15·8	8·19	8·8, 13·5	6·64	2 BC
			297·4	51·34	A = 6·5	6·64	2 AB
A 1218	... 21 19·1	+30 50	22·2	3·57	8·5, 9·7	6·65	2
Küstner 66	... 22 50·2	+32 32	1·3	3·52	...	6·88	3
Σ 2975 rej.	... 23 1·6	+32 29	288·5	29·95	9·0, 9·0	6·92	2

Notes.

h 5450 *h* has no description.

h 629 The only other measures are those of HΣ:—

AB	71°·45	10″·92	1885·83
AC	74·15	71·35,	,,

h 636 The only other measures are mine:—

	287°·5	20″·08	2n 1904·78

h 3272 The only other measures are by *β*:—

AB	341°·7	19″·58	2n	1879·86
AC	295·0	29·36	2n	,,
AD	42·7	33·48		

h 493 *h*'s place 1^m too small. There is a third star more distant in the same direction.

h 506 *h*'s dec. should be increased 1°.

h 844 Not found; star here given is BD + 33°·2192, preceding *h*'s place by 3^m 10^s.

h 1390 The faint *comes* C is too difficult to measure satisfactorily.

h 1688 No star in this place. The star here given is BD + 30°·4529, which is 2^m following *h*'s place.

h 966 *h*'s observation was made when it was cloudy, and the primary was consequently underrated and the third star missed. The third star was seen but not measured by HΣ. The only measures of AB are those of HΣ:—

268°·90	13″·13	1885·76

Various Stars.

15 Trianguli A, strong orange red; B, very blue.

New Double Stars. By Rev. T. E. Espin.

No.	B.D.	R.A. 1900. h m	Decl. 1900. ° ′	P. °	D. ″	Mags.	Date. 1900+.	Nights.
312	...	0 12·0	+34 35	237·3	2·15	9·6 10·0	6·95	2
313	+32·58	0 18·2	+32 27	16·3	3·95	8·7 12·7	6·95	2
314	+28·95	0 30·6	+28 41	201·7	8·36	8·5 14·0	6·77	3
315	+28·101	0 32·5	+28 40	77·7	2·04	9·1 9·4	6·78	3
316	+32·154	0 47·3	+32 43	292·3	1·92	9·3 9·7	6·95	2
317	...	0 54·9	+31 56	187·1	6·59	9·2 9·4	6·71	2
318	+30·223	1 21·0	+30 55	71·0	2·72	9·5 11·0	6·71	2
319	+32·256	1 22·9	+33 2	290·7	1·75	9·3 9·8	6·95	1
320	+33·310	1 46·5	+33 25	161·2	1·87	8·5 9·5	6·95	2 AB
				259·8	9·95	C=10·0	6·95	2 AC
321	+29·333	1 51·6	+30 5	181·2	3·63	9·2 10·0	6·82	2
322	+32·374	1 59·6	+32 39	92·2	2·32	9·5 9·6	6·96	2
323	+33·425	2 21·9	+33 39	179·8	6·35	9·1 10·3	6·96	2
324	+28·448	2 33·2	+28 28	20·2	1·80	9·1 11·0	6·97	1 BC
				185·8	32·75	A= 9·0	6·97	1 AB
325	+30·465	2 49·8	+31 10	0·1	12·92	7·9 12·5	6·94	3
326	+31·536	2 59·6	+31 39	36·1	4·79	9·8 10·8	6·91	3 BC
				35·8	102·33	A= 8·0	6·88	2 AB
327	+32·652	3 33·5	+33 9	292·9	14·00	8·3 12·0	6·95	1
328	+34·761	3 47·1	+34 46	288·4	6·82	8·3 14·0	6·99	2
329	+30·601	3 53·7	+30 31	255·9	7·27	9·0 12·5	6·94	3
330	+31·834	4 51·7	+31 7	156·1	3·95	9·2 12·0	6·92	2
331	+35·971	4 59·1	+35 32	324·0	7·60	8·6 11·0	6·95	1
332	+33·1017	5 14·8	+33 17	210·1	14·65	8·3 8·5	6·95	2
333	+31·936	5 15·2	+31 22	36·7	3·37	9·2 9·3	6·92	2
334	S 483	5 21·8	+33 42	347·9	15·09	8·0 14·0	6·11	2 BC
				50·5	95·48	A= 7·0	6·11	2 AB (S. 483)
335	+32·1012	5 23·9	+32 34	330·6	2·65	9·1 9·2	6·95	1
336	+31·1027	5 31·0	+31 43	258·6	8·47	8·7 9·0	6·92	2
337	+31·1191	5 49·0	+33 13	296·7	5·45	9·1 12·0	6·92	2
338	+36·1361	6 0·9	+36 37	19·5	8·17	8·5 11·5	6·94	2
339	+32·1460	6 54·8	+32 33	186·7	16·40	6·5 13·0	7·04	2
340	+31·1491	7 0·1	+31 51	139·5	5·62	9·0 9·2	6·94	2
341	+32·1522	7 13·0	+32 37	251·6	3·05	9·0 9·0	6·95	1
342	...	17 52·0	+31 21	235·4	5·82	9·0 10·7	6·67	2
343	+31·3133	17 52·7	+31 12	282·8	8·46	9·0 11·7	6·69	2
344	+33·2994	17 53·6	+33 52	30·7	8·96	8·6 9·1	6·63	2

No.	B.D.	R.A. 1900. h m	Decl. 1900. ° ′	P. °	D. ″	Mags.	Date. 1900+.	Nights.
345	+31°3195	18 7·3	+31 22	19·4	2·45	9·1 9·3	6·64	2
346	+32°3102	18 17·1	+32 10	307·0	6·10	9·5 13·0	6·58	2
347	+32°3103	18 17·2	+32 17	66·6	1·75	9·0 9·2	6·62	4
...	+29°3420	18 54·4	+30 1	172·3	17·91	9·0 9·4	6·71	2
348	+28°3210	19 5·0	+28 15	256·3	5·53	8·7 11·2	6·76	2
349	+31°3482	19 6·8	+31 35	220·8	6·65	9·3 13·0	6·58	2
350	+31°3487	19 7·0	+31 57	235·3	5·41	8·5 9·3	6·58	2
351	+33°3398	19 13·3	+33 21	82·4	6·15	8·8 11·0	6·81	1
352	+34°3504	19 17·1	+34 15	133·0	4·67	8·9 10·0	6·81	1
353	+33°3457	19 23·7	+33 7	296·4	3·36	8·6 10·2	6·75	3
354	+31°3785	19 44·5	+31 29	324·4	9·20	8·6 11·5	6·74	4
355	+31°3814	19 48·1	+31 27	294·8	13·05	7·4 13·0	6·70	3
356	+31°3816	19 48·3	+31 24	343·1	5·74	8·9 9·8	6·70	3
357	OΣ 389	19 48·7	+30 52	306·5	9·42	6·5 12·0	6·66	3 AB
				183·4	12·57	C= 8·5	6·66	3 AC (OΣ 389)
358	+31°3914	19 59·7	+31 33	197·3	7·42	8·6 10·0	6·63	3
359	+31°3915	19 59·8	+31 28	61·1	5·71	11·5 13·0	6·60	2 BC
				131·8	27·91	A= 6·5	6·60	2 AB
...	+30°3900	20 2·9	+30 58	62·3	27·37	8·8 9·5	6·78	3 AB
				251·2	33·40	C= 9·3	6·78	3 AC
360	...	20 3·5	+30 48	78·2	2·74	9·8 9·9	6·66	2
361	+30°3908	20 4·0	+30 23	113·5	4·82	9·0 11·0	6·68	2
362	+30°4008	20 19·0	+30 16	268·2	4·48	11·0 13·2	6·67	2 BC
				229·4	9·18	A= 8·7	6·67	2 AB
363	+30°4018	20 19·4	+30 33	280·4	3·05	9·3 9·3	6·71	3
364	+31°4089	20 23·4	+31 25	277·3	8·47	8·7 12·5	6·66	3
365	+31°4125	20 29·0	+31 25	288·2	2·50	12·0 12·1	6·81	3 CD
				262·1	25·72	7·7 11·5	6·73	2 AB
				318·9	33·68	...	6·81	3 AC
366	+30°4159	20 40·4	+31 2	122·7	3·29	9·1 13·0	6·69	2
367	+29°4161	20 41·0	+29 52	242·5	7·27	9·1 14·0	6·88	1
368	+30°4180	20 43·9	+30 38	357·9	2·88	9·5 9·6	6·64	2
369	+31°4226	20 44·6	+31 37	300·4	6·73	8·9 12·0	6·69	2
370	+31°4227	20 45·0	+31 26	39·2	5·81	9·3 13·5	6·82	3
371	+30°4227	20 49·9	+31 0	132·7	3·67	9·0 9·3	6·66	3
372	+31°4272	20 52·1	+31 35	144·2	2·97	9·1 9·4	6·74	4
373	...	20 54·6	+29 56	147·4	2·49	9·8 11·5	6·69	2
374	+31°4319	20 58·6	+31 22	230·4	4·5±	11·0 13·6	6·81	3
				137·1	24·78	A= 8·2	6·75	2

No.	B.D.	R.A. 1900. h m	Decl. 1900. ° ′	P.	D.	Mags.	Date. 1900+.	Nights.
375	+30°4335	21 4·6	+30 38	221°9	4″40	9·0 9·5	6·64	2
376	+30°4411	21 17·9	+30 20	214·7	10·61	8·6 12·7	6·78	2
377	+31°4430	21 18·1	+31 13	210·0	2·49	9·7 10·0	6·84	2 BC
				290·8	49·38	A= 9·1	6·84	2 AB
378	+31°4470	21 24·7	+31 58	202·7	7·74	8·6 11·0	6·69	2
379	+29°4444	21 28·9	+29 48	300·3	8·77	9·0 10·5	6·72	2
380	+29°4452	21 30·4	+29 50	310·9	2·46	11·2 11·5	6·74	3 CD
				52·2	13·85	8·5 14·0	6·79	1 AB
				106·9	57·85	...	6·71	2 AC
381	+31°4539	21 40·5	+31 17	109·5	4·89	8·7 13·5	6·59	2
382	+31°4560	21 46·6	+32 11	319·1	10·95	7·7 14·0	6·73	6 AB
				320·4	60·22	C= 7·8	6·81	1 AC
383	+34°4586	21 57·0	+34 43	168·1	4·62	9·2 11·6	6·95	2
384	+31°4612	21 58·4	+31 41	66·5	2·99	9·1 9·2	6·63	2
385	+32°4340	22 2·4	+34 6	35·6	5·17	9·0 10·5	6·94	2 AB
				36·2	33·60	C=10·0	6·95	1 AC
386	+33°4427	22 2·5	+33 5	75·7	6·95	8·6 12·7	6·94	2
387	...	22 5·0	+32 53	268·5	1·65	10·0 10·2	6·74	4
388	+31°4653	22 8·8	+31 38	262·6	7·56	8·8 9·3	6·65	2
389	+29°4620	22 11·6	+30 7	261·7	7·38	9·0 10·0	6·72	2
390	+32°4406	22 18·2	+32 57	262·1	13·98	9·0 9·3	6·75	3
391	+29°4687	22 28·3	+29 50	347·1	5·64	9·2 11·2	6·79	3
392	8 Lacertæ	22 31·4	+39 6	224·7	9·36	8·8 13·2	6·90	4 Dd
				185·4	21·66	...	6·86	1 AB (Σ 2922)
				154·3	28·14	...	6·86	1 BC ,,
				115·9	41·67	...	6·86	1 CD ,,
393	+30°4785	22 38·9	+30 42	259·4	9·43	8·8 12·0	6·64	2 BC
				297·5	78·48	A= 8·5	6·63	1 AB
394	+29°4764	22 42·3	+30 4	338·9	4·57	9·1 11·1	6·80	2
395	+29°4812	22 51·8	+30 6	351·3	4·05	9·2 12·0	6·71	2
396	...	22 58·7	+30 50	27·7	3·81	9·3 9·4	6·67	2
397	+32°4598	23 5·6	+32 36	151·8	5·55	9·2 11·4	6·94	2
398	...	23 18·8	+31 45	264·2	4·09	9·1 11·0	6·67	2
399	+29°4937	23 24·3	+29 17	207·1	8·53	9·3 12·0	6·76	2
400	+29°4938	23 24·6	+29 18	211·3	6·40	9·3 9·9	6·76	2
401	+29°4970	23 31·8	+30 14	71·8	1·60	9·3 11·5	6·92	2
402	+31°4949	23 34·8	+32 5	88·1	4·15	9·2 13·0	6·91	1
403	+30°5001	23 35·7	+30 34	294·7	2·75	9·2 9·5	6·92	2

Notes.

322 Discordant angles.

325 Observed, in the first instance, in mistake for *h* 329.

332 A fine pair, not given in any double star catalogue as far as I am aware.

334 South's measures are :—

P. 30° 53′ Nf D. 87″·602, 1825·11. The change is due to the proper motion of A, which, according to Argelander (Bonn Observations, vol. viii.) is 0″·20 at 202° 49′, according to Porter 0″·19 at 180°. The measures of South and my own give 0″·195 at 174°·1. A. has two faint *comites* Nf and Sf.

337 Closely p *h* 713.

351, 352 The second night's measures were obtained with difficulty, through a fog.

357 There seems to be no notice of the closer *comes* in the measures of previous observers. It is a fairly easy object, even in moonlight.

365 BC Angles discordant.

374 Measures of BC very uncertain.

377, 380 Angles of BC discordant.

387 A little pair N of π Pegasi.

392 The faint *comes*, d, was detected in 1892, but has not hitherto been measured.

Observations of the Occultation of Saturn by the Moon, 1906 October 27. By John Tebbutt.

The sky was beautifully clear and the definition good during the observation of this phenomenon. A magnifying power of 74 diameters was employed on the 8-inch equatorial. The following are the observed local mean times of the different phases :—

	h	m	s
Ring began to disappear . . .	8	17	57·3
Bisection of ball	8	18	17·3
Simultaneous disappearances of ball and following edge of ring . .	8	18	48·2
Disappearance of Titan . . .	8	20	9·9
Ball began to emerge . . .	9	33	39·5
Last contact of ball . . .	9	34	21·4
Last contact of ring . . .	9	34	58·3

The beats of the chronometer were inaudible at the disappearance. The times were therefore noted by turning the eye instantly from the eyepiece to the face of the chronometer. A large fraction of a second was, doubtless, lost in this way, and the times were consequently noted rather late. The first contact of the ball was unfortunately missed, as it followed so quickly after that of the ring. At the reappearance the chronometer beats were audible,

and the observations made by eye and ear. It was difficult to fix the exact times of the contacts of the ring in consequence of its great ellipticity. A star of about the eighth magnitude, which I took to be Titan, disappeared suddenly, but, owing to the overpowering brilliancy of the bright limb, its reappearance could not be observed. It became visible when two or three minutes of arc from the limb. The brilliancy of the planet was, of course, very much less than that of the Moon. This is the third occultation of Saturn seen at this Observatory.

The Peninsula, Windsor, N. S. Wales:
1906 *November* 25.

Mean Areas and Heliographic Latitudes of Sun-spots in the Year 1905, *deduced from Photographs taken at the Royal Observatory, Greenwich; at Dehra Dûn; at Kodaikánal Observatory, India; and in Mauritius.*

(*Communicated by the Astronomer Royal.*)

The results here given are in continuation of those printed in the *Monthly Notices*, vol. lxvi. p. 85, and are deduced from the measurements of photographs taken at the Royal Observatory, Greenwich; at Dehra Dûn; at the Kodaikánal Observatory, India; and at the Royal Alfred Observatory, Mauritius.

Table I. gives the mean daily area of umbræ, whole spots, and faculæ for each synodic rotation of the Sun in 1905; and Table II. gives the same particulars for the entire year 1905 and the four preceding years, for the sake of comparison. The areas are given in two forms: first, projected areas; that is to say, as seen and measured on the photographs, these being expressed as millionths of the Sun's apparent disc; and next, areas as corrected for foreshortening, the areas in this case being expressed in millionths of the Sun's visible hemisphere.

Table III. exhibits for each rotation in 1905 the mean daily area of the whole spots (corrected for foreshortening), and the mean heliographic latitude of the spotted area for spots north and for spots south of the equator, together with the mean heliographic latitude of the entire spotted area and the mean distance from the equator of all spots; and Table IV. gives the same information for the year as a whole, similar results for the four preceding years being added, as in the case of Table II.

Tables II. and IV. are thus in continuation of the similar tables for the years 1874 to 1888 on pp. 381 and 382 of vol. xlix. of the *Monthly Notices*, and for the years 1889 to 1902 on pp. 465 and 466 of vol. lxiii., and for the years 1901 to 1904 on pp. 86 and 87 of vol. lxvi.

The rotations in Table I. and Table III. are numbered in continuation of Carrington's series (*Observations of Solar Spots made*

at Redhill, by R. C. Carrington, F.R.S.), No. 1 being the rotation commencing 1853 November 9. The assumed prime meridian is that which passed through the ascending node at mean noon of 1854 January 1, and the assumed period of the Sun's sidereal rotation is 25·38 days. The dates of the commencement of the rotations are given in Greenwich civil time, reckoning from mean midnight.

TABLE I.

No. of Rotation.	Date of Commencement of each Rotation.	No. of Days on which Photographs were taken.	Mean of Daily Areas.					
			Projected.			Corrected for Foreshortening.		
			Umbræ.	Whole Spots.	Faculæ.	Umbræ.	Whole Spots.	Faculæ.
	1905. d							
686	Jan. 5·53	28	229	1655	1987	166	1255	2128
687	Feb. 1·87	27	395	2746	2584	270	1938	2703
688	Mar. 1·20	28	229	1992	2234	155	1385	2394
689	28·52	27	99	632	2194	66	421	2333
690	Apr. 24·80	27	170	1145	1865	113	782	2009
691	May 22·02	27	87	567	2348	65	437	2632
692	June 18·22	27	222	1523	2309	156	1123	2533
693	July 15·43	28	309	2174	2633	230	1672	2902
694	Aug. 11·64	27	181	1200	3057	130	882	3238
695	Sept. 7·89	27	136	916	2476	98	692	2642
696	Oct. 5·16	28	399	3096	2401	288	2206	2610
697	Nov. 1·45	27	365	2607	3009	263	1939	3176
698	28·76	27	190	1204	2707	133	850	2829

TABLE II.

Year.	No. of Days on which Photographs were taken.	Mean of Daily Areas.					
		Projected.			Corrected for Foreshortening.		
		Umbræ.	Whole Spots.	Faculæ.	Umbræ.	Whole Spots.	Faculæ.
1901	359	14	41	23	9	29	29
1902	349	14	86	163	10	62	178
1903	350	67	434	875	51	340	970
1904	363	93	653	1639	67	488	1761
1905	364	230	1637	2433	163	1191	2612

TABLE III.

No. of Rotation.	Date of Commencement of each Rotation.	No. of Days on which Photographs were taken.	Spots NORTH of the Equator.		Spots SOUTH of the Equator.		Mean Heliographic Latitude of Entire Spotted Area.	Mean Distance from Equator of all Spots.
			Mean of Daily Areas.	Mean Heliographic Latitude.	Mean of Daily Areas.	Mean Heliographic Latitude.		
	1905. d			°		°	°	°
686	Jan. 5·53	28	594	11·88	661	15·29	− 2·44	13·68
687	Feb. 1·87	27	682	13·37	1256	16·75	− 6·14	15·56
688	Mar. 1·20	28	875	10·52	510	16·48	+ 0·58	12·71
689	28·52	27	175	16·42	246	18·08	− 3·71	17·39
690	Apr. 24·80	27	439	16·55	343	15·88	+ 2·34	16·26
691	May 22·02	27	224	11·61	213	14·25	− 0·99	12·90
692	June 18·22	27	688	9·52	435	14·47	+ 0·23	11·44
693	July 15·43	28	1142	12·55	530	14·96	+ 3·83	13·31
694	Aug. 11·64	27	638	12·04	245	17·65	+ 3·81	13·60
695	Sept. 7·89	27	423	13·69	268	14·38	+ 2·80	13·96
696	Oct. 5·16	28	2168	11·31	38	13·74	+10·88	11·35
697	Nov. 1·45	27	1422	9·59	517	14·71	+ 3·11	10·96
698	28·76	27	429	10·55	421	15·31	− 2·25	12·91

TABLE IV.

Year.	No. of Days on which Photographs were taken.	Spots NORTH of the Equator.		Spots SOUTH of the Equator.		Mean Heliographic Latitude of Entire Spotted Area.	Mean Distance from Equator of all Spots.
		Mean of Daily Areas.	Mean Heliographic Latitude.	Mean of Daily Areas.	Mean Heliographic Latitude.		
			°		°	°	°
1901	359	22	8·59	7	16·27	+2·82	10·37
1902	349	42	18·81	21	15·29	+7·48	17·64
1903	350	132	18·11	208	21·15	−5·85	19·94
1904	363	268	16·33	220	16·88	+1·37	16·57
1905	364	750	11·66	440	15·55	+1·60	13·10

The principal features of the record for 1905 are—

1. The great increase in the mean daily spotted area as compared with 1904, both the umbræ and the whole spots showing an advance of 144 per cent. The actual area attained, 1191, surpassed that of the year 1883, the year of maximum in the first complete cycle registered at Greenwich.

2. This increase has been fairly general throughout the year, no fewer than seven rotations in 1905 exceeding in area the most active rotation of 1904. Three periods of remarkable activity were noticed,—the first three months of the year, the month of July, and the months of October and November.

3. The faculæ have, as usual, maintained a more steady rate of advance than the spots, the mean daily area showing no great fluctuation from one rotation to another, and the whole year showing an advance upon 1904 of only 48 per cent.

4. Comparing the whole spots of the two hemispheres, the northern hemisphere has preserved and increased its superiority over the southern, the area for the former being to that of the latter as 63 to 37. In the two preceding cycles this proportion between the two hemispheres was reached about two years before the maximum, the balance being heavily in favour of the southern hemisphere by the time the maximum was reached.

5. Notwithstanding this small relative activity of the southern hemisphere, usually much the more disturbed at maximum, the distribution of spots in latitude appears to point to 1905 having been the year of maximum of the present cycle, since the mean distance from the equator of all spots barely exceeded 13°. This corresponds very closely to the values obtained in 1883 and 1893, the years of maximum in the two preceding cycles.

6. Whilst the Sun was never free from spots in 1904, there were two days on which this occurred in 1905.

7. The distribution of spots in latitude was somewhat wider than in 1904, every latitude from the equator up to 32° being represented, an arrangement usually characteristic of the maximum year of the cycle.

8. The number of separate groups of spots was 355, as compared with 276 in the previous year. The average size of the groups was nearly double that observed in 1904. Indeed, the most striking peculiarity of the Sun-spot record in 1905 was the great number of abnormally large groups; Group No. 5441, seen from 1905 January 29 to February 11, attaining on four consecutive days a greater area than that of any other spot as yet included in the Greenwich measures.

9. Of the 353 separate groups, 209 were in the northern hemisphere and 144 in the southern.

Royal Observatory, Greenwich:
1907 *January* 8.

Observations of Minor Planets from Photographs taken with the 30-inch Reflector of the Thompson Equatorial at the Royal Observatory, Greenwich, during the year 1904.

(*Communicated by the Astronomer Royal.*)

The following positions of minor planets were obtained from photographs taken with the 30-inch Reflector during the year 1904.

The plates were measured with the astrographic micrometer. Four reference stars were, as a rule, measured with the planet, their positions being derived when possible from the Catalogues of the Astronomische Gesellschaft.

The positions given are not corrected for Parallax.

log Parallax Correction = log Parallax Factor − log Δ.

Date and G.M.T. 1904.				Apparent R.A.	Apparent Dec.	Log. Parallax Factor. R.A.	Dec.
d	h	m	s	h m s	° ′ ″		
				(388) Charybdis.			
Feb. 15	11	14	15	8 37 23·50	+25 8 58·7	+8·423	+0·588
				(37) Fides.			
Feb. 13	9	16	7	8 38 15·32	+22 51 42·0	−9·271	+0·646
15	10	20	15	8 36 30·84	+22 54 28·3	−8·817	+0·624
17	10	31	32	8 34 53·47	+22 56 38·6	−8·469	+0·621
18	9	0	26	8 34 10·21	+22 57 28·1	−9·241	+0·642
				(106) Dione.			
Feb. 8	10	43	15	8 51 22·22	+24 1 3·2	−9·002	+0·612
13	9	40	59	8 47 21·28	+24 15 35·3	−9·217	+0·622
15	10	45	13	8 45 46·07	+24 20 50·0	−8·605	+0·601
17	11	14	14	8 44 15·15	+24 25 34·7	+8·448	+0·599
18	9	24	5	8 43 34·78	+24 27 36·0	−9·192	+0·617
				(313) Chaldea.			
Feb. 13	10	7	58	9 22 52·37	+1 43 1·5	−9·210	+0·826
18	9	45	8	9 19 6·55	+2 46 31·8	−9·206	+0·820
				(505) Cava.			
Feb. 15	7	7	9	4 59 26·67	+25 19 57·2	−8·423	+0·585

Date and G.M.T. 1904.		Apparent R.A.	Apparent Dec.	Log. Parallax Factor. R.A.	Dec.
d	h m s	h m s	° ′ ″		
		(454) Mathesis.			
Mar. 10	9 40 24	10 20 17·95	+19 29 59·2	−9·158	+0·677
15	10 19 20	10 16 8·23	+19 35 36·0	−8·609	+0·665
16	10 11 8	10 15 22·35	+19 36 8·9	−8·675	+0·665
		(334) Chicago.			
Mar. 10	10 17 29	10 44 52·75	+10 57 47·2	−9·079	+0·759
16	10 36 16	10 41 22·74	+11 21 57·5	−8·673	+0·752
		(47) Aglaja.			
Mar. 10	10 54 17	10 53 21·84	+ 9 48 15·1	−8·870	+0·766
16	10 56 33	10 48 31·24	+10 9 4·9	−8·386	+0·762
21	11 21 12	10 44 43·14	+10 24 16·4	+8·728	+0·760
		(134) Sophrosyne.			
Mar. 21	10 53 3	11 57 6·16	−4 59 54·4	−9·025	+0·862
Apr. 6	10 14 22	11 41 50·68	−4 23 37·0	−8·635	+0·860
9	11 4 22	11 39 21·15	−4 17 3·0	+8·771	+0·860
12	10 33 53	11 37 5·26	−4 11 1·3	+8·505	+0·859
		(46) Hestia.			
Apr. 6	10 44 2	11 47 34·42	+1 28 10·5	−7·903	+0·827
9	11 35 41	11 45 22·72	+1 44 27·8	+8·984	+0·826
12	11 0 24	11 43 21·85	+1 59 28·1	+8·804	+0·824
		(19) Fortuna.			
Apr. 9	12 0 6	11 54 36·68	−0 30 15·1	+9·082	+0·839
12	11 27 0	11 52 27·80	−0 14 18·3	+8·955	+0·837
		(288) Glauke.			
Apr. 15	10 46 36	12 43 47·46	+3 30 59·7	−8·565	+0·813
18	9 47 51	12 41 50·39	+3 41 49·6	−9·031	+0·813
21	11 18 59	12 39 58·55	+3 51 5·2	+8·771	+0·811
		(403) Cyane.			
Apr. 15	11 20 34	12 55 19·51	−16 56 23·3	−00	+0·911

Date and G.M.T. 1904.				Apparent R.A.			Apparent Dec.			Log. Parallax Factor. R.A.	Dec.
d	h	m	s	h	m	s	°	′	″		
					(317) Roxane.						
Apr. 15	11	55	2	12	57	59·69	−3	46	54·9	+8·708	+0·857
18	10	13	20	12	55	20·35	−3	29	18·2	−8·948	+0·855
					(478) Tergeste.						
Apr. 15	12	24	4	13	9	2·07	−18	27	7·7	+8·913	+0·914
18	10	52	17	13	6	55·91	−18	2	50·2	−8·687	+0·914
May 3	9	52	26	12	57	43·24	−15	56	18·0	−8·521	+0·908
					(121) Hermione.						
May 18	10	28	59	15	39	42·22	−15	49	46·7	−9·144	+0·902
19	10	25	36	15	38	56·63	−15	48	37·6	−9·140	+0·903
31	10	26	44	15	30	0·93	−15	36	33·1	−8·650	+0·907
June 3	10	39	31	15	27	54·95	−15	34	16·5	−7·220	+0·907
					(90) Antiope.						
May 18	10	59	36	15	48	12·92	−19	13	5·0	−9·029	+0·914
19	11	3	26	15	47	22·69	−19	11	9·4	−8·972	+0·915
31	11	13	51	15	37	29·78	−18	48	13·6	+8·306	+0·917
					(79) Eurynome.						
May 18	11	31	28	16	10	8·24	−16	55	13·9	−8·951	+0·909
19	11	48	16	16	9	10·23	−16	51	14·5	−8·726	+0·911
31	10	52	42	15	57	40·48	−16	5	26·7	−8·681	+0·908
June 3	11	36	22	15	54	51·46	−15	54	37·3	+8·682	+0·908
					(153) Hilda.						
May 18	12	5	30	16	9	8·83	−18	19	39·6	−8·527	+0·915
					(176) Idunna.						
June 3	12	8	10	16	34	24·59	+2	5	38·3	+8·546	+0·823
					(322) Phæo.						
June 20	11	44	54	17	41	49·22	−20	25	32·9	−7·533	+0·913
July 5	12	1	37	17	27	56·92	−19	37	49·2	+9·163	+0·912
6	10	55	49	17	27	9·34	−19	34	58·4	+8·660	+0·918
8	11	2	37	17	25	32·43	−19	29	8·1	+8·860	+0·917

Date and G.M.T. 1904. d h m s	Apparent R.A. h m s	Apparent Dec. ° ′ ″	Log. Parallax Factor. R.A.	Dec.
(217) Eudora.				
July 6 11 54 38	17 39 55·81	−5 32 37·9	+9·061	+0·865
8 11 48 36	17 38 37·13	−5 41 41·6	+9·078	+0·865
9 12 29 54	17 37 58·32	−5 46 42·3	+9·271	+0·863
11 11 6 18	17 36 48·81	−5 56 45·6	+8·875	+0·868
(419) Aurelia.				
June 18 11 29 32	18 34 19·55	−17 39 12·2	−9·108	+0·909
20 12 14 47	18 32 46·38	−17 33 59·8	−8·585	+0·913
July 1 11 3 37	18 23 59·46	−17 11 37·8	−8·844	+0·911
6 12 14 5	18 20 4·20	−17 4 46·8	+8·935	+0·910
(364) Isara.				
July 6 13 11 46	20 16 9·54	−21 26 19·2	−8·013	+0·924
8 13 14 17	20 14 19·22	−21 38 27·8	+8·014	+0·924
15 11 38 22	20 7 23·58	22 21 30·6	8·974	+0·923
20 11 51 35	20 2 1·29	−22 52 31·6	−8·469	+0·927
21 11 11 35	20 0 57·75	−22 58 21·0	−8·952	+0·924
(483) Seppina.				
July 20 13 31 25	20 44 46·44	+2 15 51·3	+8·804	+0·822
Aug. 2 11 20 2	20 36 19·55	+1 10 8·9	−8·707	+0·829
6 11 9 26	20 33 41·31	+0 44 47·7	−8·583	+0·832
8 10 38 36	20 32 24·21	+0 31 29·0	8·863	+0·833
(115) Thyra.				
Aug. 2 11 52 49	20 54 15·72	−16 46 59·1	−8·477	+0·911
8 11 18 4	20 47 17·32	−16 37 37·3	8·564	+0·910
12 10 18 24	20 42 44·02	−16 30 50·6	−9·009	+0·907
17 10 26 52	20 37 13·10	−16 21 27·3	−8·667	+0·909
(511) Davida.				
July 20 13 1 12	20 31 49·86	−24 24 8·5	+8·586	+0·929
(539) Pamina.				
Aug. 8 11 55 29	21 20 9·94	−6 55 32·7	−9·080	+0·871
12 11 7 38	21 16 36·39	−6 59 31·2	−8·867	+0·873
17 11 7 37	21 12 8·46	−7 6 34·0	−8·528	+0·874

Date and G.M.T. 1904. d h m s	Apparent R.A. h m s	Apparent Dec. ° ′ ″	Log. Parallax Factor. R.A.	Dec.
(236) Honoria.				
Aug. 8 12 22 17	21 17 22·40	−5 20 3·0	+8·351	+0·865
12 10 40 55	21 14 22·18	−5 44 14·6	−9·050	+0·866
17 10 48 11	21 10 35·02	−6 17 35·6	−8·784	+0·870
18 11 7 39	21 9 50·11	−6 24 35·4	−8·382	+0·871
(372) Palma.				
Aug. 18 12 39 15	22 13 16·96	−10 6 21·7	+8·356	+0·887
Sept. 3 9 26 32	21 57 43·84	− 9 56 22·2	−9·200	+0·881
7 9 23 33	21 53 58·20	− 9 53 10·9	−9·125	+0·883
9 9 48 48	21 52 8·02	− 9 51 21·3	−8·897	+0·885
(389) Industria.				
Sept. 3 9 48 54	22 15 54·24	+0 27 27·5	−9·177	+0·833
7 9 46 18	22 12 29·89	+0 11 8·5	−9·103	+0·835
9 10 24 0	22 10 49·87	+0 2 34·0	−8·721	+0·836
16 9 12 17	22 5 32·92	−0 27 35·0	−9·054	+0·839
(95) Arethusa.				
Sept. 7 10 14 0	22 23 46·92	+11 33 29·2	−9·006	+0·753
9 10 50 35	22 22 18·94	+11 21 46·8	−8·442	+0·752
12 11 8 59	22 20 12·51	+11 3 11·3	+8·388	+0·754
(284) Amalia.				
Sept. 3 11 4 12	23 23 0·11	+11 38 25·2	−9·146	+0·755
7 10 47 1	23 19 40·24	+11 9 28·9	−9·136	+0·759
9 11 47 9	23 17 56·45	+10 53 3·4	−8·415	+0·755
16 9 45 9	23 12 11·47	+ 9 50 59·4	−9·216	+0·772
(331) Etheridgea.				
Sept. 9 12 12 13	23 16 30·46	−10 58 33·5	+8·253	+0·891
Oct. 3 9 14 12	22 58 44·98	−11 43 26·8	−8·957	+0·892
(405) Thia.				
Sept. 19 9 19 48	23 50 26·78	+16 58 5·5	−9·384	+0·725
20 10 12 45	23 49 33·81	+16 52 9·0	−9·205	+0·708
Oct. 3 7 53 18	23 38 55·46	+15 26 25·8	−9·423	+0·745
8 9 34 25	23 35 8·40	+14 48 35·9	−8·930	+0·721
12 9 46 10	23 32 24·11	+14 17 56·1	−8·559	+0·723

Date and G.M.T. 1904. d h m s	Apparent R.A. h m s	Apparent Dec. ° ′ ″	Log. Parallax Factor. R.A.	Dec.
(373) Melusina.				
Sept. 19 10 36 16	0 1 27·41	−2 53 23·3	−9·152	+0·851
Oct. 3 9 50 34	23 48 18·73	−2 42 33·8	−9·036	+0·851
8 10 7 27	23 44 1·02	−2 36 7·2	−8·650	+0·851
12 10 10 58	23 40 52·74	−2 29 33·8	−7·982	+0·851
(258) Tyche.				
Sept. 16 10 11 5	23 59 2·79	+14 4 27·0	−9·298	+0·741
19 9 2 31	23 57 15·55	+13 27 36·7	−9·429	+0·761
20 9 57 23	23 56 37·38	+13 14 7·4	−9·281	+0·747
27 10 43 0	23 52 19·98	+11 36 48·9	−8·863	+0·750
(375) Ursula.				
Sept. 19 9 42 6	0 1 59·20	+11 33 33·8	−9·347	+0·766
20 10 31 20	0 1 2·27	+11 33 17·4	−9·164	+0·756
Oct. 3 8 26 10	23 49 20·87	+11 20 17·2	−9·369	+0·769
8 10 32 5	23 45 5·19	+11 11 29·6	−7·814	+0·753
(370) Modestia.				
Oct. 3 10 30 57	0 25 11·04	+18 39 30·5	−9·034	+0·682
8 10 57 55	0 20 22·26	+18 11 5·2	−8·372	+0·681
12 11 4 57	0 16 45·25	+17 45 7·6	+8·304	+0·686
13 10 1 31	0 15 54·76	+17 38 37·8	−8·884	+0·690
(68) Leto.				
Sept. 16 11 45 16	1 7 57·01	−2 13 55·3	−9·190	+0·848
19 10 55 53	1 5 46·97	−2 20 35·5	−9·309	+0·847
20 10 51 3	1 5 0·96	−2 22 49·0	−9·309	+0·847
27 11 5 31	0 59 10·98	−2 37 53·8	−9·138	+0·850
Oct. 3 10 58 42	0 53 47·49	−2 48 47·7	−9·011	+0·852
Nov. 3 9 48 35	0 30 19·77	−2 33 46·7	+8·158	+0·851
(482) Petrina.				
Oct. 3 11 19 54	0 49 1·97	−0 45 10·5	−8·803	+0·831
13 10 28 10	0 42 10·62	−0 38 54·3	−8·863	+0·840
(447) Valentina.				
Oct. 13 11 23 10	0 48 28·96	−1 36 59·8	+7·681	+0·845
14 11 45 59	0 47 41·85	−1 40 30·5	+8·694	+0·846

Date and G.M.T. 1904. d h m s	Apparent R.A. h m s	Apparent Dec. ° ′ ″	Log. Parallax Factor. R.A.	Dec.
(546) Herodias.				
Oct. 14 11 5 10	0 57 14·71	+3 53 53·3	−8·505	+0·811
(335) Roberta.				
Nov. 12 9 53 56	2 21 38·28	+5 50 34·0	−8·986	+0·798
14 9 48 59	2 19 56·89	+5 43 42·7	−8·957	+0·799
(17) Thetis.				
Nov. 12 9 29 0	2 21 42·55	+4 54 36·3	−9·129	+0·806
14 9 25 14	2 19 59·71	+4 48 53·5	−9·104	+0·806
(170) Maria.				
Nov. 12 10 53 51	2 32 29·58	+38 55 55·8	−8·392	+0·275
14 10 54 13	2 30 22·26	+38 41 29·8	−7·612	+0·283
(178) Belisana.				
Nov. 14 11 22 22	2 27 5·87	+14 9 55·4	+8·693	+0·725
(298) Baptistina.				
Dec. 5 10 26 8	3 13 40·46	+27 17 9·6	+8·255	+0·553
7 8 55 47	3 11 47·93	+27 10 44·6	−9·099	+0·569
(443) Photographica.				
Dec. 5 10 58 53	3 19 56·19	+11 30 35·4	+8·767	+0·751
7 9 26 48	3 18 19·53	+11 25 26·4	−8·881	+0·752
(154) Bertha.				
Nov. 14 11 49 48	4 36 54·73	+37 17 59·6	−9·158	+0·360

Observations of Occultations of Stars by the Moon, made at the Royal Observatory, Greenwich, in the Year 1906.

(*Communicated by the Astronomer Royal.*)

Day, 1906.		Phenomenon.	Telescope.	Power.	Moon's Limb.	Mean Solar Time of Observation. h m s	Observer.
January	4	Disapp. ξ^2 Ceti	Great Equatorial	670	Dark	4 12 3·57	W. B.
	4	,, ,, ...	Astrographic Equatorial ...	225	,,	4 12 2·34	H. F.
	4	,, ,, ...	Sheepshanks Equatorial ..	100	,,	4 12 3·03	J. S.
	4	,, ,, ...	Great Equatorial (Corbett) ...	120	,,	4 12 3·57	B. E.
	10	,, γ Geminorum ...	Sheepshanks Equatorial ...	100	Bright	12 3 58·84	V.
February	3 (*c*)	,, Aldebaran	Astrographic Equatorial	225	Dark	5 22 30·36	H.
	3 (*g*)	,, ,, ...	Sheepshanks Equatorial ...	100	,,	5 22 29·70	H. F.
	3 (*y*)	,, ,, ...	Sheepshanks Equatorial (finder)	100	,,	5 22 31·10	J. S.
	3 (*a*)	Reapp. ,, ...	Astrographic Equatorial ...	225	Bright	6 28 34·15	H.
	3	,, ,, ...	Old Altazimuth	100	,,	6 28 34·23	A. C.
	3	,, ,, ...	Thompson Equatorial (Hodgson)	100	,,	6 28 (38·02)	D. E.
	3	,, ,, ...	Sheepshanks Equatorial	100	,,	6 28 34·28	W. S.
	3	Disapp. W.B. (2) IV. 724 ...	Astrographic Equatorial ...	225	Dark	8 54 46·89	J. S.
	4	,, 115 Tauri	,, ,, ...	225	,,	5 24 48·29	W. S.
	4 (*f*)	Reapp. ,, ...	,, ,, ...	225	Bright	6 33 10·60	W. S.
	7 (*c*)	Disapp. ζ Cancri	,, ,, ...	400	Dark	7 6 59·59	H.
	7 (*e*)	,, ,, ...	Great Equatorial	670	,,	7 6 58·24	B.
	7 (*c*)	,, ,, ...	Sheepshanks Equatorial	100	,,	7 6 58·01	J. S.
	7	,, ,, ...	Merz Refractor	250	,,	7 6 57·44	P. M.
	7	,, ,, ...	Thompson Equatorial	100	,,	7 6 58·24	R. F.

Day, 1906.		Phenomenon.	Telescope.	Power.	Moon's Limb.	Mean Solar Time of Observation. h m s	Observer.
February	7 (*e*)	Disapp. ζ Cancri (Comes) ...	Great Equatorial	670	Dark	7 6 58·24	B.
	7	,, Piazzi VIII. 6 ...	,, ,, ...	670	,,	7 7 7·12	B.
	7 (*c*)	,, Piazzi VIII. 6 ...	Sheepshanks Equatorial... ...	100	,,	7 7 5·99	J. S.
	7	,, Piazzi VIII. 6 ...	Merz Refractor	250	,,	7 7 6·32	P. M.
March	2	,, θ^2 Tauri	Astrographic Equatorial ...	225	,,	12 2 16·10	W.
	6	,, B.D. + 18°, 1752	,, ,, ...	225	,,	7 38 36·28	W. S.
	29 (*a*)	,, B.D. + 14°, 657 ...	Sheepshanks Equatorial... ...	100	,,	9 0 12·91	R. C.
April	3	,, d^2 Cancri	Great Equatorial	670	,,	9 37 28·24	W. S.
	3	,, ,, ...	Great Equatorial (Corbett) ...	120	,,	9 37 28·24	W.
	3	,, ,, ...	Sheepshanks Equatorial... ...	100	,,	9 37 28·66	V.
	3	,, ,, ...	Sheepshanks Equatorial (Finder)	100	,,	9 37 28·16	A. W.
	4	,, π^2 Cancri	Astrographic Equatorial ...	225	,,	6 36 22·99	W. S.
	5	Reapp. Regulus	Sheepshanks Equatorial... ...	100	Bright	6 42 5·34	A. C.
	6	Disapp. χ Leonis	,, ,, ...	100	Dark	7 3 7·95	A. C.
	6	,, ,, ...	Great Equatorial...	670	,,	7 3 7·80	H. F.
	6	,, ,, ...	Great Equatorial (Corbett) ...	120	,,	7 3 8·30	G. C.
	6	,, ,, ...	Astrographic Equatorial ...	225	,,	7 3 7·50	W. S.
	27 (*a*)	,, 119 Tauri	,, ,, ...	225	,,	8 49 38·62	H. F.
	27	,, ,, ...	Sheepshanks Equatorial... ...	100	,,	8 49 38·82	J. S.
	27	,, ,, ...	Astrographic Equatorial ...	225	,,	8 49 39·02	W. S.
	27	,, ,, ...	Old Altazimuth	100	,,	8 49 39·02	B. E.
	27 (*a*)	,, 120 Tauri	Astrographic Equatorial ...	225	,,	9 27 22·31	H. F.

Day, 1906.	Phenomenon.	Telescope.	Power.	Moon's Limb.	Mean Solar Time of Observation. h m s	Observer.
April 27	Disapp. 120 Tauri	Sheepshanks Equatorial	100	Dark	9 27 22·11	J. S.
27	,, ,, ...	Old Altazimuth	100	,,	9 27 23·06	A. W.
September 9 (*c*) (*d*)	Reapp. B.A.C. 1391 ...	Astrographic Equatorial	225	,,	11 58 13·14	W.
9 (*a*)	Disapp. Aldebaran	,, ,, ...	225	Bright	14 26 41·78	W.
9	Reapp. ,, ...	,, ,, ...	225	Dark	14 43 31·21	W.
November 5	,, *ν* Geminorum ...	Sheepshanks Equatorial	100	,,	12 34 43·49	S. E.
19	Disapp. *o* Sagittarii	Astrographic Equatorial ...	225	,,	5 29 0·96	H. F.
22	,, W.B. XXI. 1281 ...	Sheepshanks Equatorial	100	,,	6 48 53·21	J. S.
22	,, ,, ...	Astrographic Equatorial ...	225	,,	6 48 52·16	W. S.
December 5	Reapp. B.A.C. 3029 ...	Sheepshanks Equatorial	60	,,	17 8 1·35	A. C.

(*a*) Instantaneous.
(*c*) Very faint, cloudy.
(*d*) Not a very good observation.
(*e*) Disappeared simultaneously.
(*f*) The observer was looking at the exact point of reappearance.
(*g*) Very windy—clock-beats inaudible.

The apertures of the telescopes used are as follows:—

Great Equatorial	28 inches.	Sheepshanks Equatorial	$6\frac{3}{4}$ inches.
Thompson Equatorial	26 ,,	Great Equatorial (Corbett Telescope) ...	$6\frac{1}{2}$,,
Merz Refractor	$12\frac{3}{4}$,,	Thompson Equatorial (Hodgson)	6 ,,
Astrographic Equatorial (Guiding Telescope)	10 ,,	Old Altazimuth	4 ,,

The initials, H., A. C., B., D. E., W. B., H. F., W., J. S., P. M., W. S., S. E., R. C., V., B. E., R. F., G. C., A. W., are those of Mr Hollis, Mr Crommelin, Mr Bryant, Mr Edney, Mr Bowyer, Mr Furner, Mr Witchell, Mr Storey, Mr Melotte, Mr Stevens, Mr Eddington, Mr Cullen, Mr Vagg, Mr B. Evans, Mr Fowler, Mr Cody, and Mr Witney, respectively.

Royal Observatory, Greenwich.

The Latitude of the Royal Observatory, Edinburgh.

(*Communicated by Professor F. W. Dyson.*)

The latitude of the Royal Observatory, Edinburgh, is given in the *Nautical Almanac* as 55° 55′ 28″·0. This provisional value was derived from an observation of *α Cassiopeiæ* in the prime vertical by Dr Becker on 1889 October 8.

From 1898 April to the present time observations have been made of Sir David Gill's list of Zodiacal Stars. The observations as far as 1906 February have been reduced in the first instance—

(i) With an assumed latitude, 55° 55′ 30″·0.
(ii) Bessel's Refractions.
(iii) No correction for flexure.

Comparison of the resulting declinations has been made with Newcomb's Fundamental Catalogue, and with the Zodiacal Catalogue published in the Papers of the American Ephemeris, vol. vi. pt. 3, which is also reduced to Newcomb's system.

The results of this comparison are shown in the first four columns of the following table. The observations are very scanty from the pole to Z.D. 30° S., but are plentiful from Z.D. 30° to 70°.

The differences, when the observations are corrected to the Pulkowa system of refractions, are given in column 5.

The observations of flexure made between 1898 April 13 and 1906 February are as follows:—

Date.	Hor. Flexure.	Date.	Hor. Flexure.
	″		″
1898 April 13	+1·20	1905 February 23	+0·88
	+1·12	April 15	+1·03
	+0·98		+1·07
	+0·80	April 19	+0·89
1902 September 16	+1·53		+0·80
1903 August 24	+1·62	November 7	+0·84
	+1·52	———	———
1903 August 27	+1·12	Mean	+1″·10
	+1·14		

The observations during the year 1906 have given a somewhat smaller value. I have taken the correction for flexure, in round figures, as −1″·00 sin Z.D. When this correction is applied the differences from Newcomb are those of the last column of the following table:—

Comparison of the Declinations observed at the Royal Observatory, Edinburgh, 1898–1905, with Newcomb's Fundamental System.

Dec.	Z.D.	Number of Obs.	Newc.—Obs. Decns.	N–O (Pulkowa Refractions).	1″·00 sin Z.D.	N–O (Pulkowa Refn. Flexure Correction).
°	°		″	″	″	″
+91½	−36	23	−0·53	−0·42	−·59	+·17
88½	−33	19	−0·06	+0·04	−·54	+·58
59	− 3½	17	−0·13	−0·12	−·06	−·06
47	+ 8½	9	−0·24	−0·27	+·15	−·42
37½	+18	8	+0·17	+0·10	+·31	−·21
32½	+23	34	+0·27	+0·20	+·39	−·19
27½	+28	211	+0·36	+0·28	+·47	−·19
22½	+33	685	+0·57	+0·47	+·54	−·07
17½	+38	566	+0·77	+0·65	+·62	+·03
12½	+43	360	+1·12	+0·97	+·68	+·29
7½	+48	376	+0·86	+0·78	+·74	+·04
2½	+53	260	+1·09	+0·87	+·80	+·07
− 2½	+58	325	+1·14	+0·89	+·85	+·04
− 7½	+63	418	+1·21	+0·90	+·89	+·01
−12½	+68	297	+1·44	+1·05	+·93	+·12
−17½	+73	495	+1·43	+0·96	+·96	00
−22½	+78	196	+1·28	+0·68	+·98	−·30
−26½	+82	81	+0·93	+0·22	+·99	−·77

Consideration of these residuals shows that the latitude may be taken as 55° 55′ 30″·0. The observations from $-34\frac{1}{2}^\circ$ to $+34\frac{1}{2}^\circ$, though few, give this result whatever correction be applied for flexure. The observations from Z.D. $+34\frac{1}{2}^\circ$ to Z.D. 73° support the adopted correction for flexure. At the zenith distances 78° to 82° there is a marked discordance, but the observations at higher zenith distances support the change from Bessel's to the Pulkowa refractions.

The reduction of the observations which form the material on which this determination of the latitude is based have been accelerated, thanks to a grant from the Government Grant Committee of the Royal Society.